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The Engineering and Mining Journal

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Mexico

Disturbances in Mexico are again plaguing the mining industry of that unhappy country. During the last week or two revolutionists have taken the mining towns of Velardeña, Mapimi and Parral, committing serious outrages, and disorder has prevailed in many other places. The removal of the strong hand of Diaz has let loose selfish ambition and given free rein to the inclination of bandits. Madero undertook a grave task and has not yet had reasonable time to make headway with it. With the collapse of the plot of Reyes it seemed that Madero was going to have a fair chance, but later events have dispelled that hope. It is still two early to pronounce whether Madero is equal or unequal to the problem that confronts him. In his own words, "The difficulties through which the Republic of Mexico have been passing were not of really great importance and have been overcome. There has been no great political principle involved and there has been no notable leader as their sponsor. For all these reasons my government is sufficiently strong to give complete protection to all of the interests." This statement is probably correct as to the absence of any great political principles and notable leadership in the case, but otherwise it is undoubtedly over-optimistic, as the daily outrages reported in the newspapers show clearly.

Americans residing in Mexico are naturally exasperated by the situation, but there is nothing for them to do but to be patient, continue to restrain themselves, and, if possible, take themselves out of harm's way. Any propaganda for American intervention would be like pouring gasoline on the flames. It is highly gratifying that the Americans in Mexico have so far behaved in a quiet and correct manner. They will best conserve their lives and property by continuing to act in that way. The situation in Mexico is particularly vexatious to those who are engaged in the mining industry. There is nothing to be done, however, but to grin and bear it.

Settling Mill Slimes

When leaching was the only means of applying the cyanide process the presence of slime in the material to be treated was particularly objectionable. In those days crushing apparatus was judged largely by its ability to grind the ore with the production of a minimum quantity of slime. The introduction of simple devices for separating sand and slime and efficient means for handling slime caused a reversal of the procedure until now all-sliming is common practice.

With this change the necessity for accurate knowledge of the nature of slime was developed. To such good purpose have certain investigators carried their researches that we are now in possession of a good deal of valuable data on the subject.

Essentially slime is made up of crystalline and colloidal material; an increase in the proportion of the colloids causing a decrease in the settling rate. Since pure water was found to have a decided solvent effect on crystalline minerals, crushing in water would tend to produce an excess of colloids. Crushing in the presence of lime was suggested as one means of preventing this action; a protective coating being formed on the crystals. Lime acts as a coagulant and hastens the settling of slime, but since the settling rate varies inversely as the viscosity of the supporting liquid a large excess of the alkali obviously should be avoided.

While the basic facts in this matter are known among cyanide operators, the laboratory tests carried on for the direction of mill operations often give results which do not work out in practice. To those who have experienced such difficulty the article of D. L. H. Forbes elsewhere in this issue will be particu-

larly welcome. Mr. Forbes sets forth in a concise manner the conditions which should be observed in making tests on the settlement of slime in order to forecast accurately the behavior in large-scale operations. An apparently unique method of applying the information gained by preliminary tests in the design of settling plants is proposed.

The Steel Rail Question

The steel-rail question, which was so actively discussed two or three years ago, has come up again in active form, chiefly because of several recent accidents which are attributed to broken rails. It was supposed to have been settled at the time by the adoption of more careful methods of rolling and discard, and partly by the increased use of openhearth steel for rails; but this seems to have been only a temporary truce between buyers and users. A conference of representatives of the two parties was held recently in New York, at which it is understood that sharp differences of opinion were developed.

The claim of the railroads is that the mills have turned their attention to economy and rapidity of manufacture rather than quality of product; that they have been inclined to haste and carelessness in rolling and have tried to use up the ingots too closely, without discarding a sufficient part of the defective ends. Naturally, these charges are denied, and the mills claim that railroad specifications are made up with a sole regard for wear. They want a hard steel to resist abrasion, with a section giving all possible metal in the head, and cutting down the web and foot to the smallest possible dimensions. These sections, with the hard steel, make a difficult rail to roll, and increase the liability to cracks and eventually breaks in the web. A softer and tougher steel, with a better distribution of metal, would decrease the liability to breakage. Moreover, it is urged that sufficient allowance has not been made for the great increase in the weight of locomotives and cars during recent years. In support of their claim the railroads' representatives say that most of the failures investigated occurred on rails made in 1906 and 1907, when the mills were rushed with orders and production was pushed to its highest possible point.

The dispute rests here until some compromise can be found. Something is to be said in favor of the claims of both parties, though it looks as if the rail-makers had rather the better of it so far, from a technical point of view.

Manipulation and Methods

There seems to be an everblooming perennial interest in schemes for quick slag analysis, and the average smelting chemist usually ends in inventing a scheme to cut the corners of the methods in common use. Much of the inventive force thus spent, is, however, wasted energy, which might be more profitably spent in investigating what other chemists have already done. Thus, the use of alcoholic and ethereal hydrochloric acid instead of aqueous, has been described, and there is hardly any stunt of such time-saving value as this, yet it seems comparatively little known. Again, the precipitation of copper and lead by hydrogen sulphide in dilute solution, leaving the silica hydrated, or the instant precipitation of copper and simultaneous reduction of any ferric iron by means of a little test lead, are both good schemes, and deserve more extended use than is given. The gooch crucible and pressure filtration ought to be in every chemist's home. When, with existing methods, it is possible to run Fe, CaO, SiO_2, Cu and Pb in about 22 min., it has become more a question of the man and his manipulation, rather than of methods. for cutting more seconds off this record.

The British Coal Strike

Negotiations for a settlement of differences between the British coal miners and operators have made no progress, and recent advices indicate that the general strike of the miners will begin on March 1. The result will doubtless be a wide spread industrial disturbance. It is understood that options have been taken on considerable quantities of West Virginia coal, to provide against such a contingency. Leaders of the British miners have been negotiating with the Belgian and German unions as to steps to prevent shipments of coal from those countries to England. No European country, however, is in a position to make large exports of coal; in fact many of them import British coal. Latest advices are that the government will intervene and endeavor to bring about a compromise.

Chinese Pig Iron

It is going rather far afield—or looking rather far ahead—to find in possible Chinese competition an argument against the reduction of the duties on iron and steel. The possibilities of foreign competition do not lie in that direction. China has at present one modern steel plant, the Hangyang Works, and is still a large importer of ironwork of all kinds. A rather sensational contract was made a year or two ago by a Seattle corporation for the importation of Chinese pig iron; but we cannot find that any considerable quantity was brought here under that contract, and the Seattle company is now in the hands of a receiver. China has possibilities for iron manufacture in the way of ores and coal, but the time is distant when it may be counted as a competitor for our trade; or for any other foreign trade except that of Japan and its dependencies.

In the testimony offered before the Senate committee on the iron tariff bill several prominent witnesses referred to the lower wages paid in Germany; but we do not see that any of them made mention of the extent to which the German ironmakers profit from the use of byproducts. Possibly they hardly appreciated it themselves; possibly also they did not care to call attention to our own disregard of possible economies. The fact is that while our attention has been given to increasing production and rapidity in handling material, we are far behind the German metallurgists in saving byproducts and the utilization of what we have been in the habit of regarding as waste. A closer attention to possible savings might be enforced by a little foreign competition.

Silver last week went above 60c. per oz. in New York, the first time it has reached that level since the latter part of 1907. It is still very close to 60c., and seems likely to hold up to that point for some time. It is now about 8c. above the price recorded a year ago. The chief causes for the advance are found in the unexpectedly large demand from China and India; and in the strong Indian speculation, which is based on the belief that the government will be forced before long to add largely to its silver coinage.

Metallics

Metals are practically without electric resistance at temperatures near absolute zero.

Immersing zinc shavings in a solution of lead acetate before using in the boxes increases the efficiency of the precipitation, due to the electrolytic action of the lead-zinc couple.

The use of tinned-copper scrap by copper refiners for making cakes is sometimes attended by bad results. The tin seems to segregate, and when the copper is rolled, the plates show small white spots.

An ink for writing on blueprints may be made by dissolving 75 grains of potassium oxalate in an ounce of water, thickened with a little gum arabic. The paper must be washed thoroughly after using the ink.

At the Cia. Minera las Dos Estrellas mill, El Oro, Mex., a Trent agitator, installed in a 36x20-ft. tank, is operated with 7½ hp. on pulp containing 6% on 80 mesh, 55% on 120, 2% on 200 and 37% through 200 mesh.

For cutting large glass tubes, wrap a strip of thick paper around the tube where the cut is required, and then make a cut clear around the tube with a file, using the paper as a guide. Take off the paper and run a red-hot, sharp-pointed iron around the tube in the file scratch.

Boiler-feed water should not be heated by the direct exhaust of a steam engine. The cylinder oil is carried into the boiler and in time forms a film on the surface of the water. At times of low water this film of oil will adhere to the boiler plates or tubes, and will not rise when the water level is reëstablished. This thin film of oil is a poor conductor of heat and may prevent the water in the boiler from cooling the plates. The plates may then become overheated and softened so as to bag under normal boiler pressure.

The largest ladder dredge in the world was recently completed by William Simon & Co., of Renfrew, Scotland, for use on the Panama Canal. This new dredge, which is to be known as the "Corozal," will soon be at work on the Pacific end of the canal. The dredge discharges directly into hoppers or barges alongside, and has a steaming speed of 10 knots per hour. It is to be capable of digging to a maximum depth of 55 ft., and is expected to have a digging capacity of 1200 cu.yd. per hour. The dredge is provided with two sets of buckets, one with buckets of 54 cu.ft. capacity each, and the other set with buckets of 34 cu.ft. each. These buckets are made with cast-steel backs, and bodies of pressed plates of mild steel. The lips are of manganese steel, forged to shape, and afterward tempered.

By the Way

John Hays Hammond said at a dinner in New York of a financier who had failed: "No wonder he failed. His methods were inept. He was the sort of man who'd start the promotion of a new gold mine by naming it the Munchausen-Cook."

Wall Street has lately been exercised by rumors of an exchange of Amalgamated for Anaconda shares, on the basis of two of Anaconda for one of Amalgamated, which inspired the *Evening Post* to remark that that would be a singular performance. The Anaconda is a holding company, and the Amalgamated holds it. For the inside holding company to swallow the outside holding company would be a feat impossible physically, though feasible enough, no doubt, financially.

It would seem a pleasant occupation, next summer, to undertake the development of the "Cold-as-Hell" claim, which has just been located in the Georgetown district in Montana; it should be remembered, however, that the Never Sweat mine is one of the hottest in Butte. Speaking of names, the Bunko mine in the Empire district, says the Anaconda *Standard,* made its fortunate owners rich, while the Ophir near Marysville never paid a dividend, its original owner dying of starvation.

Apropos of the "Blue Sky" law to protect Kansans, mention of which was made in these columns recently, the securities of one of those Kansas mining companies has been advertised in a Topeka paper as "a legitimate business proposition backed by a gold bond of the ———— Securities Co., of Los Angeles, Calif." But who guarantees the bond? This sounds like the "cat-rat" farm where the rats eat the carcasses of the cats that live on the rats, etc., the profits of all the "skins" going into the pockets of the promoters.

Since the disintegration of the Standard Oil Company of New Jersey an extraordinary and to most people an unexpected turn of prosperity has overtaken the oil business. Oil prices have been advanced several times. Even the Texas Co., created by the late John W. Gates, says the *Evening Post,* has become suddenly prosperous, to judge from the rise in its securities on the Stock Exchange, where only a few months ago they were desperately weak. Frugal investors holding Standard Oil fractions jeer at their improvident relations who own automobiles and tell them it serves them right. This is a condition strongly at variance with the popular expectations raised in October, 1910, by an official statement from the Standard Oil Co. on the state of the oil business. The statement baldly set it forth that there had been a great overproduction of oil in the world. In three years, 1906 to 1909, the world's production of crude oil had increased 42½%, whereas the world's business in refined oil had increased only 10%, from 48,000,000 to 53,000,000. And at that time, according to the statement, there was held in tanks in the United States alone 115,000,000 bbl., or considerably more than two years' consumption. That was only 16 months ago. Either the production of oil must have enormously decreased or the consumption has run mad.

The expression "wedge rock" is used on the Comstock lode to designate rock that carries some metallic content but not high enough for "pay ore" or "second-class ore"; it usually assays under $5 per ton. The expression came into use in the early days of the Comstock lode and has been in vogue ever since. When a car is placed on the cage to be hoisted from the mine, a wooden wedge is placed on top of the car, indicating to the top carman to what class it belongs. In this manner the term "wedge rock" came to be applied to what is generally termed low-grade ore. Pay ore is tagged as such with special tags, as is the second-class ore. Waste rock is not tagged at all.

For gross wordly wisdom says the Toronto *Globe,* it would be difficult to surpass the "Ten Demandments" hanging in one of the many salmon canneries at Steveston, Western Canada:

(1) Don't lie. It wastes my time and yours. I am sure to catch you in the end, and that is the wrong end.

(2) Watch your work, not the clock. A long day's work makes a long day short; and a short day's work makes my face long.

(3) Give me more than I expect, and I will give you more than you expect. I can afford to increase your pay if you increase my profits.

(4) You owe so much to yourself you cannot afford to owe anybody else. Keep out of debt, or keep out of my shops.

(5) Dishonesty is never an accident. Good men, like good women, never see temptation when they meet it.

(6) Mind your own business, and in time you'll have a business of your own to mind.

(7) Don't do anything here which hurts your self-respect. An employee who is willing to steal for me is willing to steal from me.

(8) It is none of my business what you do at night. But if dissipation affects what you do the next day, and you do half as much as I demand, you'll last half as long as you hoped.

(9) Don't tell me what I'd like to hear, but what I ought to hear. I don't want a valet to my vanity, but one for my dollars.

(10) Don't kick if I kick. If you're worth while correcting you're worth while keeping. I don't waste time cutting specks out of rotten apples.

Adirondack Gold Schemes

By D. H. Newland*

For many years the Adirondacks have been the camping ground of process promoters engaged in enlisting public support for their schemes to work the alleged gold-bearing sands of that region. The absolute futility of their enterprise is, no doubt, appreciated by readers of the Engineering and Mining Journal, but in view of the need for bringing the facts to general attention, I hope the opportunity which its columns afford to that end may not be denied.

The methods of procedure in the business are mostly of one pattern. The first essential is a process. After this has been introduced on the scene, usually in some new locality each time, there follows the period of experimental mystification, during which local interest is created and sufficient funds obtained to erect a more or less elaborate plant. Some waste sand lots that can be calculated into the millions of tons and as many more dollars as would make the stockholders all and severally candidates for the plutocratic class, if they should win, are thrown in for a good measure. The sand, however, is a secondary matter—worthless to anybody who has not a share in the process and not less remunerative apparently in one place than another. The advertised recoveries run all the way from $5 to $50 per ton; the cost of extraction a dollar or less. It is evident that with the process in working order, a field is opened that would soon make South Africa a second-rate producer, and in time might overturn our whole financial system. But for some unexplained reason, after the mill is up, the machinery in place, and all made ready for operation, the gold does not materialize—to the stockholder. Then comes his unpleasant awakening from dream to reality, and another abandoned mill marks the progress of the promoter.

It is not necessary to enter upon details of the various undertakings or the several processes on which they have been based, as indeed such particulars have been carefully guarded in the information issued to the public. They all spring from the assumption that the gold exists in a peculiar condition; hence it cannot be recovered by ordinary methods, which fact has been amply demonstrated. "Volatile," "ionized," "combined," and "atomic" are some of the elusive qualities of this gold, well calculated to put an end to scientific discussion.

Credit for the discovery of this field of "enterprise" seems to belong to a man named Bullis, who carried on experiments about 20 years ago, and, in the language of one of the printed circulars, found "that fire assays were entirely unreliable, and that all methods in common use were useless." He was followed by Sutphen, who originated a process and erected plants at Glens Falls and Hadley from the proceeds of stock sales. In the years that have since elapsed, the Keystone and Waverly processes have been brought out and given trials. The Keystone seems to have had the greatest claims as a money maker, for the "tests" showed an average value of $13.97 per ton on Lewis County sands, of which the company owned 30,000,000 tons, and the cost was stated to be not in excess of $0.75 per ton.

It may seem surprising that such schemes should find support among the public, but their vitality is witnessed by the continued interest shown in them, as noted in the press and in the recent reports issued by the State Geological Survey. They appeal, naturally, to those least able to assume the financial loss which they have always entailed.

The actual sums that have been raised by these concerns must amount in all to several hundred thousands of dollars, but there is a much greater economic waste than is represented by the mere capital outlay, as need scarcely be stated. The extent of the craze that may seize upon the people during the height of a boom is well shown in the periodic scrambles for the registration of claims; in one year nearly 4000 were filed with the Secretary of State at Albany. The interest also is not purely local; inquiries in regard to the matter have come from all parts of the country.

No doubt, many engaged in the business are acting in good faith, and there is no intent here to question personal motives. It seems, however, an opportune time to throw some light on a situation which is hardly creditable to the mining industry.

*Assistant State Geologist, Albany, N. Y.

Laboratory to Test Potash Minerals

To develop more thoroughly the fertilizer and potash resources of the United States, Secretary Wilson of the Department of Agriculture has established at Reno, Nevada, a laboratory for the examination of natural material thought to contain potash. The laboratory has been organized under a coöperative agreement between the Mackay School of Mines, the Bureau of Soils, and the United States Geological Survey. The laboratory is in charge of Prof. George J. Young, of the Mackay School of Mines, and A. R. Merz, of the Bureau of Soils. Facilities have been provided for the examination and assay of all potash-bearing materials and of saline waters. The laboratory will be at the disposal of the public free of charge.

In speaking of the arrangement, Secretary Wilson said, "All samples should be addressed to: Coöperative Laboratory, Mackay School of Mines, Reno, Nev. Dry samples should at least be one-half pound in weight, should be securely wrapped and tied, and marked with the name and address of the sender. Samples of brines or water should be placed in clean bottles of at least one quart capacity, stoppered with clean corks securely tied in, and should be well packed against breakage. In all cases all transportation charges must be prepaid."

California Oil Dividends

January oil dividends were up to the normal in amount, while falling below those of December, in which month the Buick paid a dividend covering four months' earnings, and the payments by the English capitalists on their purchase of the Imperial, Mountain Girl and Gypsy were made, and partly disbursed by the recipients as dividends. The following is the list:

JANUARY OIL DIVIDENDS

Company	Per Cent.	Amount
Caribou	0.025	$8,070
Central	0.015	15,400
Claremont	0.015	7,500
Columbia	0.01	9,992
Continental	0.01	2,500
Fullerton	0.05	30,000
Globe	0.01	6,000
Home	0.01	7,500
Homestake	0.01	1,000
Mascot	0.01	5,000
Monte Cristo	0.05	25,000
*Mount Diablo	0.01	10,000
New Pennsylvania	0.005	5,000
Olinda Land	0.01	10,000
Paraffine	0.01	3,000
Rice Ranch	0.015	4,500
Record	0.01	10,000
Sauer Dough	0.02	4,000
Section 25	0.25	10,000
*State Consolidated	0.005	5,000
Traders'	0.006	9,000
Union	0.006	183,388
Union Provident	0.006	90,767
United Petroleum	0.006	48,451
Western Union		10,000
W. K.		15,000
Total California Co.'s		$506,068
Mex. Pet., Ltd., pfd.	0.002-3	80,000
Grand total		$586,068

*Unlisted.

This table, says the San Francisco *Chronicle*, by no means represents the money paid in dividends on California oil properties, the greater portion, and, excluding the Union, the more valuable, not being listed on the stock market and their dividends not being made public.

Water Power for the Kolar Gold Field

Special Correspondence

The first stage of a scheme for supplying power to the Kolar gold field of India and for providing a canal system for irrigation purposes, has been sanctioned by the durbar of the Mysore state.

A great masonry dam, 4200 ft. in length, will be built across the River Cauvery, at a point eight miles west of Seringapatam, at a cost of $2,700,000. The dam will eventually store 41,500,000,000 cu.ft. of water. The entire project, it is estimated, will cost $76,000,000, and the canal system will irrigate 150,000 acres of land.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Basis of Calculating Tonnage Costs

Regarding the article on this subject in the JOURNAL of Feb. 3, 1912, the reduction of mining costs to the cost-per-ton basis is done, I take it, for two purposes: First, as a means of comparison with other mines, and second, as a means of comparison, weekly, monthly, or yearly, as the case may be, in the same mine.

As to the first comparison, is it not time we acknowledge that there is not, and cannot be, any practical method devised for comparing mining costs between different mines on the cost-per-ton basis, that is not dangerous, misleading, and if without a great deal of supplementary information, absolutely useless?

In the second case, however, we have a real use for the cost per ton as it gives the manager and other directly interested persons a quick and simple mode of comparing and noting variations in the cost of mining at their particular mine, into which they can inquire if they see fit.

As to whether the cost should be based on the ton mined or the ton milled, the one which gives the closest approximation to the truth in each case should, I think, be chosen; but as a matter of fact is it not better to keep the cost of milling entirely separate? In the term ton mined in most cases, to be practical, we must confine ourselves to the tonnage hoisted, and ignore any tonnage that may be hand sorted below, for to try to ascertain this tonnage would from the nature of things be a costly and at best an inaccurate refinement.

While not attempting to question, as it is not a practical solution, the statement that the theoretically true basis for comparison is the volume basis, one is tempted to ask why, and for what good reason are the old, cumbersome fathom and square fathom pushed forward and maintained as units of measurement.

I note in Mr. Hague's article the use of the word "beneficiation." I remembered that such a term was used in mining; but I unblushingly admit that I had to look it up in the dictionary to be sure of its meaning. The Standard Dictionary gives the following: "*Beneficiate* (Rare), mining. (1) To work or improve, as a mine, (2) to reduce, as ores."

It may be simpler and convey more, to speak of "mining and beneficiating" or "beneficiating and milling," as either seems to be correct, than it is to say "mining and milling," but I doubt it.

Is it not true that many of our problems in mining are rendered still more difficult and confusing by the use and abuse of unnecessary words and expressions?

JOHN T. FULLER.

Honesdale, Penn., Feb. 12, 1912.

The Slow Speed Chilean Mill

Congratulations are due Messrs. Narváez, Megraw, and other advocates of the slow, heavy chilean mill, on the conversion of a builder of stamp-battery cyanide plants to a recognition of its merits. Two remarkable features attend this conversion, however: the time required to effect it, seeing that Mr. Empson has been building stamp mills at Pachuca and Guanajuato for several years, and must have had ample opportunity to observe and compare results, and the fact that (with the exception of Mr. Megraw) he is the first foreign cyanide metallurgist to publish so decided an approval of the ancient crushing device. The reasons for this tardy appreciation may be found among those enumerated in his paper, quoted in the JOURNAL of Feb. 3, 1912, but I think he is unduly severe, considering his own experience, in hinting at ignorance and prejudice on the part of his *confrères*.

I should attribute the delay rather to a phenomenon which has frequently come under my notice during 16 years of contact with cyanide metallurgists in Mexico, and which, for lack of a better term, I may call "mental reluctivity" on their part toward suggestions and ideas emanating from mining engineers, managers, and others not strictly pertaining to "the profession"; the phenomenon occasionally assumes a pronounced form, especially when the suggestions are from a Mexican source.

SIBERIAN MILLS NOT FINE GRINDERS

The Siberian mills mentioned by Mr. Empson appear to be a compromise between the Pachuca form and the Lane slow-speed mill. Their apparently high efficiency seems to arise from the coarse screen and low discharge used, and if they were called upon to produce pulp approximating that of La Unión or Santa Elena, either in one operation or followed by a tube mill, their efficiency would be greatly lowered. In fact, working alone, it could not be expected that their sliming efficiency would approach that of the Pachuca form, due to the great distance between the rollers; as explained by Mr. Narváez (ENG. AND MIN. JOURN., Nov. 21, 1908), the greater the radius of the circular die the less the rubbing effect or twisting motion upon which sliming principally depends. If tube mills are to be added, for the purpose of producing agitation pulp, a loss of mechanical efficiency and a complication of plant ensue. Taken alone, it does not seem that the Siberian mill can compete with the Pachuca form as a slimer, however efficient it might prove in turning out a granular pulp.

The character of the work done at La Unión is not approached elsewhere, so far as I have been able to ascertain. To take 1½-in. ore, of average hardness, and reduce it to 80% through 200, at a single pass through the chilean, and with an efficiency of 46.13%, or a rate of 1.70 tons per horsepower-day, or 0.59 hp. per ton ground, certainly upsets some of the calculations of the advocates of multi-stage crushing; and when we consider the almost negligible loss of running time, the cheapness of attendance and repairs, and the extraordinary simplicity of plant, it makes a remarkable record. Mr. Megraw's work at Santa Elena shows higher mechanical efficiency; but he was not producing a pulp suitable for agitation without regrinding, as was the case at La Unión.

Mr. Megraw emphasizes the deficiency of the mill as a regrinder. It is evident that at the standard of performance given above, regrinding would rarely be required, but I am of the opinion that if the discharge were led through a Dorr classifier and the plus 200 returned to the mill, the small percentage of oversize would not be found to affect the efficiency of the mill by packing down on the die, and the classifier would act as a safeguard against coarse pulp reaching the treatment tanks. A little consideration will show that this could be arranged in a compact and satisfactory manner.

SUGGESTED IMPROVEMENTS FOR THE PACHUCA MILL

I agree with Mr. Empson that the Pachuca mill is susceptible of improvement, particularly as regards the power transmission and feed. If the crown wheel were given a sliding fit on the vertical spindle, so that it could remain at constant height even if the spindle wore at the step bearing, each mill might be driven by a Morse or Renold chain from a vertical motor, mounted on the main

frame, thus suppressing the intermediate gearing. A quarter-turn rope drive might be used, the crown wheel being changed for a rope pulley, and the drive taken from quill clutches on the line-shaft, or, with the improved efficiency of spiral gearing in late years, the mills might be driven directly from spiral pinions mounted on quill clutches on the line-shaft, the latter being driven by motor or other means.

On account of the practically continuous running time, a battery of these mills would be particularly adaptable to group driving by motor. A continuous feed, if practical, should certainly improve efficiency. The other improvements, excepting the Mantey offset already in use, would require practical demonstration. If the modernized mill proposed by Mr. Empson, followed by sufficient tube-mill capacity to regrind oversize, cannot show a higher efficiency than 0.766 hp. per ton ground, its advantages would seem doubtful. There would seem to be no reason why all cast parts of the mill proper should not be made in Mexico; in fact, I think this has already been done in some cases.

A further improvement in adapting the mills to harder rock would be an increase in the diameter and weight of the rollers, the die remaining unchanged. This would give a better bite on large feed, and a greater pressure per unit of die surface. Whether and under what circumstances it would be advisable to increase the width of the tires and die is a matter for investigation; mathematical analysis of the peculiar combination of twisting and rolling might determine this, and would be interesting.

I have long been impressed with the work of mills of the roller type, and have from time to time gathered data on their performances, but until the publication of Stadler's investigations no suitable form for comparing mechanical efficiency had come under my notice. With the exception of La Unión, all the plants that I know of as producing fine pulp are working in conjunction with stamps or rolls, and are followed by tube mills. As stated in the article in the JOURNAL of Aug. 5, 1911, quoted by Mr. Empson, the crucial question is the efficiency of the entire combination of machines required to reduce mill feed to fine pulp, comprising all apparatus between the rock breakers and the treatment tanks. Of course, if all the members of the combination were of high efficiency, the combination would inevitably be efficient; but this is not the case, as we find stamps of approximately 70% efficiency working in connection with tube mills of say 17%, etc.

Now that Stadler's method affords a convenient means of comparing crushing efficiencies, I suggest that the JOURNAL publish, if obtainable, figures from the leading exponents of the various crushing schemes in the United States and Mexico. For instance: Mr. Dorr, at the Mogul, and Mr. Argall, at Stratton's Independence, use rolls, fast (three-roller) chileans, and tube mills; Mr. Hutchinson, at Goldfield, is using stamps, fast chileans, and tube mills; Mr. Pattinson, at El Bote, uses slow chileans—whether followed by tube mills I cannot say; Hugh Rose, at Santa Gertrudis, has a most modern mill, with 1550-lb. stamps, followed by high tube-mill capacity; and if I am not mistaken, El Oro practice is now limited to stamps and tube mills. If these gentlemen can be induced to publish the data, and Messrs. Narváez and Megraw will give their latest results, your readers will be able to form an intelligent comparison of the relative merits of the different methods.

Such data should comprise the following: Class of crushing and grinding machinery, omitting rock breakers, power consumed by each machine in the combination, whether battery, rolls, chilean, classifier, elevators, pump, etc., handling material between the delivery of feed from mill bins and its discharge to treatment tanks; size and hardness of feed, tonnage of feed, screen analysis of discharge (preferably by dimensions of screen aperture); approximate cost of labor and repairs per ton fed; approximate cost of wearing parts per ton fed; time lost. If power is stated as input to motors, their efficiency should be given, so that the net output to the machinery itself may be figured.

Although conditions differ in all the mills mentioned, figures covering such a wide range of practice should throw much light on relative efficiencies of machinery. Metallurgists and managers are interested in knowing how many tons of ore, from a certain feed to a certain discharge, can be put through certain forms of mill, per horsepower expended; or conversely, what horsepower it requires to reduce a ton of ore to pulp, under these circumstances. As to the other points of equal or greater importance—percentage of running time, simplicity, attendance, cost and frequency of repairs, these are quite necessary in passing judgment; so far as heard from, however, the advantage in these particulars seems to be on the side of the Pachuca chilean.

E. H. WEBSTER.

San Antonio, Tex., Feb. 9, 1912.

Smoke Investigation

It may be of interest for you to know that we are entering into a study of the smoke problem in the broadest manner possible. We are taking the following as our chief lines of investigations: the effect of smoke on health, plant life and buildings. We are also considering the increased cost of living due to damage and dirt caused by smoke, and the legal as well as the engineering side of the problem. Each of these investigations will be carried out by one or more men, each a specialist in his line.

It is hoped that by coördinating these various researches it will be possible to obtain some valuable technical as well as scientific data. We will at least be able to establish the status of the problem, as a whole, on a scientific basis. I am writing at this time to see if you will not aid us by making mention of the work we are doing in the columns of the ENGINEERING AND MINING JOURNAL. We should like to get in touch with people interested for the purpose of coöperation, information and suggestions.

R. C. BENNER.

Pittsburg, Penn., Feb. 15, 1912.

Government Experiment Stations

At a meeting of the Assayers and Metallurgists of San Francisco, held Feb. 5, 1912, the following resolution was unanimously adopted:

Whereas, a bill (H. R. 17,033) has been introduced by Mr. Raker, of California, into Congress and referred to the House Committee on Mines and Mining, providing for the establishment of a government experiment station at Auburn, Placer County, Calif., at which assays, tests, analyses and miscellaneous investigations of minerals and metallurgical problems are to be made gratuitously or for a nominal charge, and

Whereas, there already exist well established private plants where this work is adequately and economically done and which meet the existing conditions along these lines,

Now, therefore, be it resolved, that while cordially approving of well directed efforts on behalf of the government in the advancement of science, we protest against any unnecessary interference with established industry and personal initiative and against this bill in particular, as an unwarranted and unwise incursion into the field of established business.

Be it also resolved, that copies of this resolution be sent to Congress, to the press and to interested technical societies.

EMORY E. SMITH, President.
ABBOT A. HANKS, Secretary.

San Francisco, Calif., Feb. 9, 1912.

Improvements in Crushing Rolls

In the article by C. Q. Payne under the above caption in the JOURNAL of Feb. 17, 1912, it was stated that the Edison corrugated rolls for pulverizing cement rock were provided with shells 30 in. diameter by 18 in. face. This is a typographical error. The width of the face is 8 in. The characteristic of the rolls are their relatively narrow corrugated face, their high peripheral velocity, and the high compression under which they are forced together by springs.

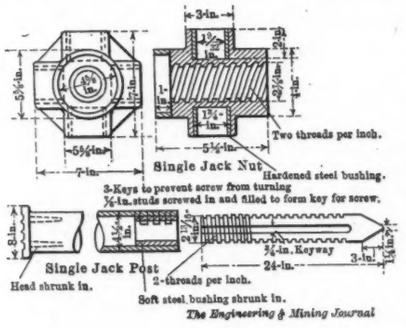
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Drill Post with Removable Screw

In the Copper Range, Hancock and Quincy mines single-screw posts, the jack screws of which are removable, are used whenever a single-screw post is required in making a cross-bar setup with a machine. The details of the screw are shown in the accompanying illustration.



DETAILS OF DRILL COLUMN WITH REMOVABLE SCREW

The device has even been used in shaft sinking and is said to have proved as satisfactory for that work as an ordinary post, while it possesses the advantage that owing to the fact that the screw feeds ahead instead of the jacking nut, as is the case in the ordinary single-screw post, the screw can be stuck into a hole in the wall, and the bar jacked without any trouble arising from projections from the wall interfering with jacking. The separate screw and nut also possess the advantage that such a single-screw jack can be used with several different lengths of bars.

The nut of the jacking device is octagonal in shape with four steel-bushed holes in its sides for receiving the jacking bar, and one end of the nut is made big enough to go over the end of the post as a collar. The screw has a blunt end that goes against the ground, while in it is a keyway that goes over three lugs in the end of the post so as to keep the screw from twisting with respect to the post as the jacking nut is turned. The post has at one end the ordinary toothed head shrunk on it, while at the other there is a soft-steel bushing or guide shrunk in for the screw. Through this end of the bar three holes are drilled and tapped for ⅞-in. studs. These studs are screwed in tightly and then filed flat to serve as the keys to go into the keyway in the jacking screw, as well as to hold in the guide bushing. The barrel of the post is a piece of ordinary 4-in. gas pipe.

Electric Hoist at Negaunee Mine

By P. B. McDONALD*

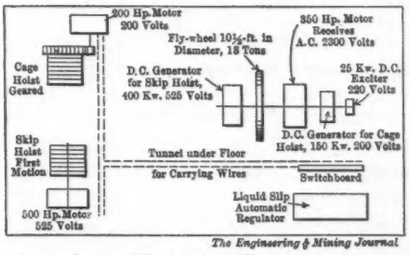
The new electric hoist installed at the Negaunee mine of the Cleveland-Cliffs Iron Co. uses direct-current motors, has a flywheel to eliminate peak loads, and an automatic regulator for varying the speed of the motor-generator.

There are two hoists, a first-motion skip hoist and a geared, cage hoist. The two hoist motors are of different power, the skip hoist 500, the cage hoist, 200 hp. The voltage is so adjusted that both motors have the same ampere capacity; this is done so that in case of a breakdown either motor can be run from either generator. Double-throw switches are provided on the switchboard so that in case of the 200-hp., 200-volt motor being run from the 400-kw., 525-volt generator, additional resistance is inserted in the field of the generator to cut down the voltage to that of the motor. If the 500-hp., 525-volt motor is run from the 150-kw., 200-volt generator it will pull the full load at about half speed so that hoisting need not be entirely stopped, but can take place at a reduced rate.

Alternating current comes to the hoist house at 2300 volts. It is led direct, to a 350-hp. induction motor which is mounted on a line shaft with the two direct-current generators, 13-ton flywheel, and 25-kw. exciter. By means of an automatic, liquid, slip regulator (in which a solution of washing-soda is used in place of the customary salt water) the speed is reduced as the load increases thus allowing the flywheel to give up its energy and so maintain practically a constant load on the transmission line.

Without this slip regulator the flywheel would not be able to give up its energy. The flywheel will run several hours after the current is turned off. It is 10 ft. 6 in. in diameter, 7 in. thick, and is built up of steel plates riveted together; it makes about 700 revolutions per minute.

The hoisting engineer has only two levers to throw. One is for starting and stopping the motor actuating the drum, the other is for controlling the brake engine which is worked by compressed air. There is an automatic safety device which throws these levers in case the engineer does not. To prevent overwinding a wheel is turned slowly by a worm gear as the drum revolves, and engages cams which, through a system of levers, cut off the power to the motor. The brake which is normally held on by a heavy weight is released by compressed air during the hoisting period. Should the drum tend to overwind due to neglect of the engineer, a safety stop opens a



LAYOUT OF NEGAUNEE ELECTRIC HOIST

valve which releases the air pressure and thus causes the brake to be applied.

This system of electric hoisting using a flywheel to obviate peak loads comes under the third system as described by D. B. Rushmore,[1] and is similar to the electric hoist installed at the Winona mine in the copper country.

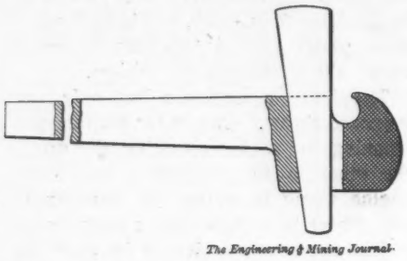
The shaft at the Negaunee mine is 940 ft. deep; there will be two skips hoisting in balance. The skip hoist is aligned with the shaft house, the cage hoist, necessarily at a small angle. Current will be furnished from the new power house under construction on the Carp River near Marquette. The wiring in the hoist house, from the switchboard to the hoist motors, is in a concrete tunnel under the floor; the tunnel is large enough for a man to work in.

*Mining engineer, Negaunee, Mich.

[1]Eng. and Min. Journ., Dec. 16, 1911.

Wrench for Removing Stuck Drills

The accompanying sketch shows the design of the wrench that is used at the Mohawk mine in Michigan to aid in loosening drills that become jammed in the hole by the drillings. As can be seen, the wrench is quite similar to the one that is used at the Calumet & Hecla mines, described in the JOURNAL of Dec. 16, 1911. The grip on the drill is obtained by driving in a key or cotter that grips the drill between itself and the jaw of the wrench. The wrench is much heavier, and does not seem to be quite



COTTER WRENCH FOR STUCK DRILLS

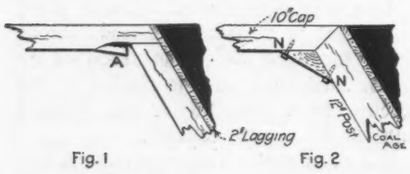
as handy as the one used at the Calumet & Hecla mines.

In working the drill out a chain is fastened to the drill, thence it is passed around the machine post. One man pulls on the chain while the other twists the drill with the wrench. In this way it is often possible to work a drill out when it is caught tightly in the drillings.

Timber Framing for Side Pressures

Side pressures in three-piece drift sets invariably split the caps when the usual method of notching is used, states Joseph Virgin in *Coal Age*. This often happens before the post has taken the full force of the side pressure.

To avoid the splitting the cap is cut at the ends at an angle of 45° and legs



METHOD OF FRAMING FOR SIDE PRESSURE

2-in thicker than would otherwise be used are employed. The upper ends of the legs are also cut at an angle of 45°. By nailing in the corner the piece cut from the end of the leg and driving two small track spikes into the cap and two into the leg, as shown at *NN*, Fig. 2, in the accompanying illustration, a strong durable joint is obtained in a quick and simple way.

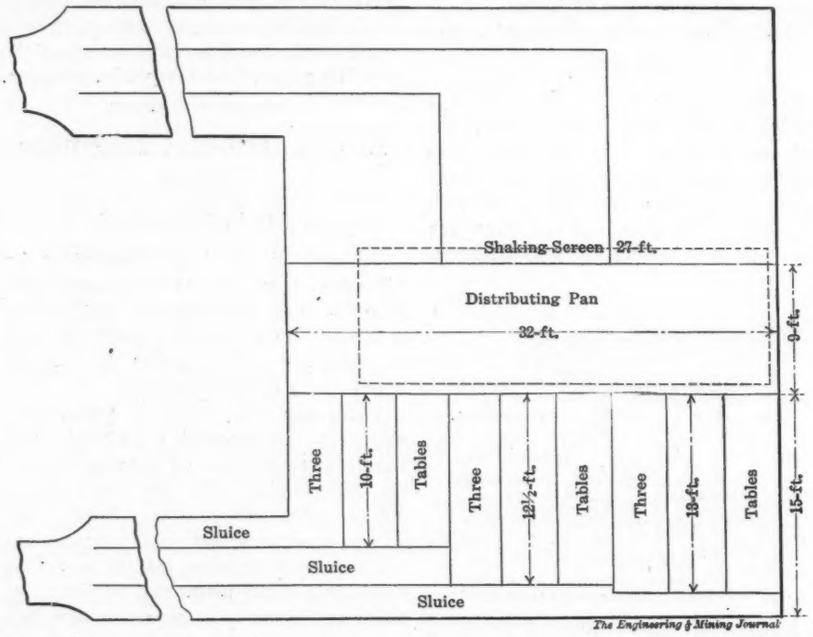
Cross System Gold Saving Tables

BY LEWIS H. EDDY

The cross-system plan of constructing gold-saving tables has been adopted by a number of dredge operators in California within the last year or two. In some instances the system was installed with the original construction of the dredge; in others it has displaced the Holmes type of longitudinal tables. The latest installation of the cross-system on a new boat, of which I have definite information was on the 4-cu.ft., close-connected, bucket-elevator dredge equipped with revolving screen. This boat was designed and constructed by John Ross Wade on Butte Creek, near Chico, in June, 1911. The latest displacement of the Holmes type by the cross system was made in December by O. C. Perry on Pacific No. 1 dredge at Oroville. This is a 7½-cu.ft. bucket-elevator dredge, equipped with shaking screen, which was sunk on Nov. 27 and raised on Dec. 7. There is a slight deviation in the Butte Creek installation from the common cross-system plan in that the positions of cross tables vary from transverse to oblique in relation to the position of the screen; but the principle and the purpose apply in both plans alike. The purpose is to avoid the variation in the flow of water caused by the fore and aft motion of the boat resulting from the lowering and raising of the digging ladder; this variation is greater in the smaller boats equipped with longitudinal tables than in the largest boats.

The gold-saving tables constructed on the cross-system plan occupy the same situation on the dredge as the Holmes type with relation to the position of the screen. The position differs: the Holmes type are longitudinal, running parallel with the screen; the cross tables at right angles. The description of the installation on the Perry dredge at Oroville applies in general terms to all installations of the cross system. The screen equipment on this dredge is the reciprocal end-shaking flat type, 27 ft. long, 9 ft. wide, provided with a distributing pan beneath the screen, 32 ft. long, 9 ft. wide. The gold-saving tables and sluices are in two series, one on each side of the screen and connected to the pan, and are alike in all respects; so that the details of one series is sufficient for the purpose of this description.

The series contains three sets of tables and three sluices. The tables extend outward and at right angles from the distributing pan, and are connected at the outer end, each to a separate sluice running longitudinally. The tables composing the first or upper set are 13 ft. long; the top or upper frame piece of the uppermost table extends 2 ft. beyond this length, or 15 ft. over all and is attached at right angles to the outside frame of the outer sluice, forming the upper outside corner of the whole structure. The tables in the second or next lower set are 12½ ft. long, and extend to the center sluice. The tables in the third or lowest set are 10 ft. long, and extend to the inner sluice. The three sluices, varying in length according to their connection to the tables, extend several feet downward and converge into one which disposes of the water that has been carried over the tables. The pitch of the



CROSS-SYSTEM OF GOLD-SAVING TABLES ON PACIFIC DREDGE NO. 1, OROVILLE, CALIF.

tables longitudinally is 1¼ in., the pitch of the sluices is 1½ in.

It is obvious that the flow of the water over tables constructed on the cross-system plan will not be affected materially by the fore and aft oscillations of the dredge digging at different depths, but that agitation across the tables will result; while varying increase in the velocity of the water and variableness of the flow over tables constructed on the longitudinal plan evidently result from such oscillation. It is true that oscillation athwart ship may result, and does so result in the operation of small dredges working on head or side-lines; but the advocates of the cross system claim that there is not enough variation to appreciably affect the flow. The Holmes type of gold-saving tables, in use for a number of years, and for a time almost exclusively, has been variously modified according to the varying constructional features of dredges and the character of ground; but the plan adopted by Perry is more than a modification; and the present installation was induced by the successful operation of the same system on No. 4 dredge. The installation at Butte Creek is less a digression and more a modification of the Holmes type.

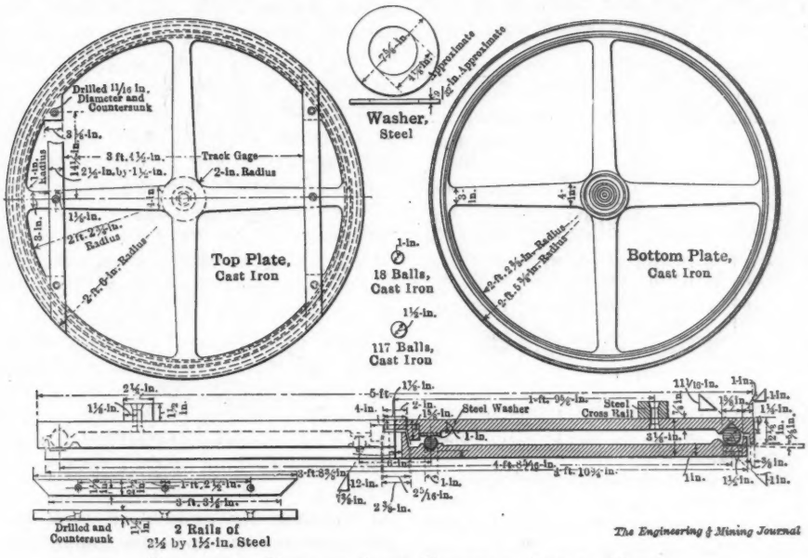
Removal of Paint and Varnish

One of the things which the newspaper is often accused of doing is publishing recipes without investigation. A contemporary recently recommended the following for the removal of varnish, paint or lacquer from hard paint brushes: 4 oz. benzol, 3 oz. fusel oil, mix and shake well, then add 1 oz. of alcohol. Allow the brush to soak for two or three hours. This mixture is good; we have tried it ourselves, but we wish to state that it required visits to eight paint and drug stores before we found one which had all the ingredients named. The cost of 8 oz. of the mixture at retail was 35c., so that it scarcely pays to make it up for one brush only. It is not a good mixture to use near open lights or fires, as it may remove the experimenter, the paint brush, and even the building, as well as the paint.

A Ball Bearing Turntable

Turntables are generally used at the shaft stations in the inclined shafts of the Lake Superior copper country, as the tram cars generally hold from 1¾ to 2½ tons. At the Tamarack, however, where the shafts are vertical and the cars hold 2½ tons as loaded, turnplates are used. These are somewhat thicker and hence more rigid than turn sheets, the usual substitute for turntables in other districts.

These turntables are not especially rapid in operation as, owing to the weight of the loads, speed is not so important as in Western mines where ton-cars are used. The turntables are put in the main tracks on the hanging-wall side of the shaft and are used so as to get the cars on the short tracks that lead right up to the edge of the plat. Some of these turntables are made with ball bearings, while others have two flat bearing rings. The turntables with the balls are stiff at first, but after the balls have worn smooth they are superior to those with bearing rings. If anything, the top part of the turntable could be cast a little heavier as occasionally an arm breaks. The gage shown is 3 ft. 4 in. which is the standard of many mines in the copper country. The drawing shows the turntables used in the Wolverine and Mohawk mines; the Calumet & Hecla company uses a similar table on tracks of four-foot gage.



TURNTABLE USED IN SOME MICHIGAN COPPER MINES

Unwatering with Electric Turbine Pumps*

BY CYRIL BRACKENBURY

The unwatering of the old Tresavean mine in Cornwall was successfully carried out by means of electrical high-lift turbine pumps, to below the 1420-ft. level below the adit 147 ft. below the surface. This is the largest and most successful operation of the kind achieved in the county with an electrical plant. Eight electrically driven high-lift turbine pumps were used in the work, but never more than three were worked together at the same time, the others were merely used as spares. Six of the pumps were designed for a delivery of 600 gal. per min. through a lift of 600 ft., when running at a normal speed of 1450 r.p.m. An extra 60-ft. head was allowed for suction lift and friction head.

Three of the pumps were used for sinking purposes, and five as station pumps. The sinking pumps were of the vertical, and the station pumps of the horizontal type. The impellers and diffusion vanes were made of phosphor bronze, and with the exception of one sinking pump, the casing of which was made of gun metal, the pump casings were made of special cast iron. The impeller shafts were made of nickel steel, and provided with water-cooled, white metal, thrust bearings. Each pump was provided with a throttle valve to regulate the discharge, immediately above which was fitted a check valve to support the weight of water contained in the rising main when the flow of water ceased from any cause. Similar check valves were placed in the rising main at distances of about 240 ft. apart. apart.

Each combined set consisted of pump and motor, bolted to the same bedplate in the case of the horizontal pumps, and to the same channel-iron frame in the case of sinking pumps. The motors were of the squirrel-cage induction type for the sinking pumps and slip-ring type for the station pumps, all arranged for three-phase alternating current, 50 cycles, 550 volts. At full load with a maximum current of 210 amperes, the motors were designed to give an output of 190 hp. The motors for the vertical pumps were of the inclosed type, water-cooled and ventilated internally by means of a revolving fan attached to the rotor shaft. The fan caused the air to circulate internally through the body of the motor, continually passing it next to the water-cooled side. This method was found satisfactory, as it kept the motor cool without danger of allowing the moisture

*Excerpt from an article entitled "Unwatering Tresavean Mine," Bull. 88, I. M. M.

in the shaft to enter the windings. The weight of the rotor was carried by a compound ball thrust bearing on the rotor shaft, which was connected to the impeller shaft by a flexible coupling, the two ends being fastened together by 16 small bolts inclosed in rubber washers.

The power plant consisted of three high-pressure Lancashire boilers and three Bellis & Morcom compound two-crank high-speed engines, directly coupled to British Electric Plant Co. alternators, one set having been installed as a spare.

The alternators were of the revolving field-magnet type, with stationary armatures, each capable of developing 250 kw. at 550 to 600 volts, three-phase, 50 cycles, 375 r.p.m. The rotor was mounted on a steel shaft. The exciter was of the open shunt-wound multipole type, directly coupled to the alternator. There were two methods of regulation, by shunt resistance in the exciter field, and by resistance between the exciter and alternator fields; the former being the only one used. Two varieties of electric cable were used for the pumps; the smaller and more flexible type was used for the sinking pumps and lowered intermittently down the shaft, while the larger and heavier type was securely fixed in the shaft and connected with the station pumps. As the sinking-pump cables were only for temporary use, the conductors were allowed to be of smaller cross-sections than usual for the maximum current which might have been used. Each cable was 7.4 in. in circumference, three-core pattern, 0.15 sq.in. section, pure and vulcanized-rubber insulated, double wire armored, braided and compounded over all; weight, about 1240 lb. per 100 yd. Each cable for the station pumps was 10 in. circumference, three-core pattern, 0.217 sq.in. section, bitumen insulated, double-wire armored, braided and compounded over all; the weight was about 3210 lb. per 100 yd.

Each of the sinking pump cables was wound on a light-built steel drum, 6 ft. diameter, 6 ft. 6 in. between flanges 9½ in. deep. The inner end of the cable was originally connected with slip rings on the end of the drum axle, but the rings being found rather small for the purpose, a plug was later used. The other end of the plug was connected with a short length of cable leading from an oil switch at the feeder panel. The farther ends of both cables, together with the wire rope which supported them, passed over three 6-ft. pulleys at the shaft's collar, and thence down the shaft to a junction box suspended at the end of the wire rope. The suspending rope was made of plow steel, 3⅞ in. circumference, and was attached to both cables by means of wooden-lined iron clamps, so as to support the entire weight of both cables. The clamps were fixed about 40 ft. apart and were designed to run on wooden guide rods fastened to the dividers of the shaft.

The two station pump cables were securely fastened in the shaft by a series of wooden iron-bound cleats about 4 ft. long and 10 in. wide, which were themselves bolted to the wall plates or other strong timbers in the shaft. These cleats were placed about 15 yd. apart. The lower end of each cable was connected with an oil switch placed at the pump station, and the upper end was connected directly with the oil switch of the feeder panel.

The winding machinery for pumps, cables and men was driven by two electric motors, and also by a small steam winch, which was used as a convenience in lowering the pumps slowly, and it could be employed in case of emergency if the electric power failed. For raising and lowering the pumps and cables there was a combination three-drum hoist, driven by a 30-hp. electric motor; drum *A* was 6 ft. diameter, 4 ft. wide between flanges 12½ in. deep; drum *B* and *C* 6 ft. diameter, 3 ft. between flanges 10 in. deep.

The unwatering was delayed from time to time when it became necessary to remove obstructions that completely choked the shaft in several places. The station pumps were installed at the 450- and 996-ft. levels. The accompanying table shows the summary of the pumping campaigns. High-lift centrifugal pumps are not suitable for raising water containing much rough material which could pass through an ordinary Cornish pump without difficulty. The holes in the sinking-pump strainers were ⅛ in. diameter.

SUMMARY OF TRESAVEAN PUMP CAMPAIGNS

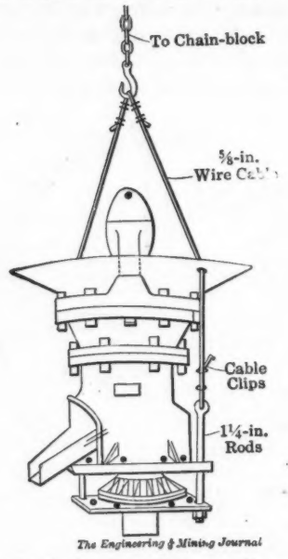
Description of Pump	Number of Campaign	Reason of Stop	Period From	Period To	Gallons Pumped	Length of Run Hr.	Length of Run Min.
No. 1 sinker	First	Failing duty	4–26–09	9–18–09	64,434,125	2415	10
No. 2 sinker	First	Failing thrust bearing	9–23–09	2–14–10	95,895,358	3001	35
No. 1 sinker	Second	Failing duty	2–17–10	6–13–10	*71,434,675	2583	0
No. 2 sinker	Second	Failing thrust bearing	6–16–10	10–10–10	*46,400,217	2073	35
No. 1 station, west	First	Thrust bearing seizing	2– 4–10	9–29–10	59,210,685	2419	0
No. 1 station, east	First	General repair	4–25–10	11–19–10	90,259,195	3405	0
No. 1 sinker	Third	Failing duty and thrust seizing	10–14–10	3– 4–11	*59,997,021	3028	10

*Could not be obtained accurately, since exact measurements were only taken of all water delivered to adit.

Generally speaking, all campaigns were stopped on account of wear and tear to pump, which caused a falling off in the duty, and a tendency for the thrust bearings to heat up.

Lowering the Bottom Plate of a Gyratory Crusher

A rapid method for lowering the bottom plate with eccentric and gear of gyratory crushers is described by J. H. Oates, *Mexican Mining Journal.* The plate is lowered by a chain-block over the crusher. The cable used is of such a length that when lowered all of the distance the chain-block hook will not come to rest upon the top of the spider hood. The cables used are ⅝ in. diameter, six strands and are fastened by clips. The lower end of the cable passes through the hopper directly above the holes in the bottom plate, where the threaded bolts go for lowering the plate. The ends are passed through eyes in bolts made fast with two clips to each cable, as illustrated. The bolts generally used are the same as those that come with the crusher, only that they have an eye welded to one end.



RIG FOR LOWERING BOTTOM PLATE OF CRUSHERS

By this method all of the bolts can be loosened while the crusher is running, and when all is ready the bottom plate can be lowered. It takes about two minutes to lower, and from five to 10 min. to raise the bottom plate, depending upon how expert the operator is in getting the shaft into place. Before taking out the plate bolts one should be sure that the cable clips are tightened thoroughly, and also that the cable is greased a little where it passes through the hopper.

Melting at the British Mint

The annual report of the British Mint, which has been published, gives an account of the operations of this department during 1910. No less than 371 tons of gold were melted during the year, being more than double the average of the 10 years, 1899-1908.

Some important changes have been made in the methods of melting the various metals used for coinage. Preliminary experiments on the use of gas and oil instead of coke have been in progess since early in 1909, and these experiments have involved the preparation of many designs for furnaces of various sizes, and the testing of a number of burners for obtaining high temperatures, some specially designed and others of patterns already in use in various trades. Electric furnaces were also experimented with.

Oil furnaces, burning both petroleum and creosote oils, were tested under varying conditions, and with air at pressures from 2 to 25 lbs., but it was finally decided that liquid fuel was unsuitable.

In the experiments with ordinary gas, states the *Gas Engineers Magazine*, a variety of systems was tested, involving the use of gas at ordinary and high pressures, combined with variations in the pressure of the air, and the burner ultimately adopted was made by S. N. Brayshaw, of Hulme, Manchester.

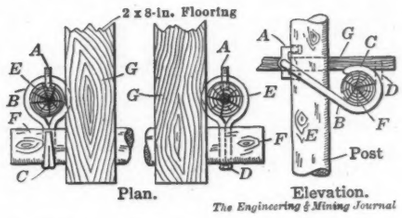
For the Brayshaw burners in use at the mint, the gas is taken at the ordinary pressure in the main, about 3 in. of water, and mixed with air from a blowing engine at about 2 lb. pressure. With care the noise of these burners can be reduced sufficiently to be unobjectionable; the furnace linings compare favorably with those hitherto used for coke in regard to endurance; and the crucibles used for gold are found to last longer, each crucible serving for an average of 18 heats as against 12 when coke is used. The adoption of gas as a fuel in place of coke has been accompanied by several incidental economies, and it is interesting to note that the present charge for fuel averages about 8½c. per cwt. of standard gold bullion as against 14c. when coke was used. It should be added that in this statement the fuel needed to warm up the furnace in the morning has been eliminated, but, including this, the cost rarely exceeds 10c. per cwt. on a day's work.

During 1910, the mint installed 16 gas-heated furnaces, each capable of taking a 400-lb. crucible. These 16 furnaces have a maximum capacity of 2¾ tons of sterling silver, or 2¼ tons of bronze per melt, and four melts of silver, or three of bronze, can be made in an ordinary working day; 8 a. m. to 6 p. m. Also five furnaces similarly gas-heated, but of a smaller size are in use for melting gold.

Considering the large quantity of metal melted at the mint, it will be seen that a substantial saving in the cost of fuel alone has been effected by the use of gas. The incidental economies are, however, still greater. The cost of carting and handling both coke and clinker is saved and the room formerly required for their storage is available for other use. The expenditure on crucibles, which is a large item, has been reduced by 33%. The work of melting is less laborious and the loss of metal much reduced.

Scaffolding for Drills in Wide Stopes

In stoping in a wide vein it is often the case, when an overhand stoping system is in use, that some provision must be made for mounting the machine drills. If a shrinkage system of stoping is being used, it may also happen that so much ore has been drawn from the stope that the height of broken ore in the stope is not sufficient to enable the miner to reach the back.



STAGE FOR DRILLING OR SAMPLING IN STOPES

In some of the Lake Superior copper mines and in certain mines of the Transvaal, long drill columns are used some of which have a length of 28 or 32 ft. It is not always convenient to keep such long columns on hand or the slope of the stope may be such as to make the use of such columns impossible.

The accompanying sketches illustrate a type of scaffolding that is much used[1] in the wide stopes of some of the mines of Western Australia. This scaffolding is built up of vertical posts *E* well footed and wedged in place at the top. At the required height steel dogs *A* are driven into holes cut in the backs of the posts. Through a hole in the backs of these dogs, pass the ring-hooks *B*, made of ⅞-in. round iron. The hooks for the end posts are curved back as shown at *C*, while those between the end posts are curved as shown at *D*. The dog holds the ring part of the hook from slipping, but most of the holding power of the hook is due to binding against the vertical post. Horizontal members *F* are carried in the hooks, and form the support for *G* the plank flooring.

Such a staging can be used for a variety of purposes about a mine besides that of supplying a stage for drilling. In sampling high backs a scaffold can be rigged with four posts set at the corners of a square with four horizontal members forming the sides of a square, that will give easy and safe access to the face to be sampled.

[1]Cleland, "West Australian Mining Practice."

Measuring the Flow of Streams

The following method of determining the approximate flow of streams, is recommended by the U. S. Geological Survey.

To ascertain the velocity of the stream choose a place where the channel is straight for 100 to 200 ft. and has a nearly constant width and depth. Lay off on the bank a line 50 or 100 ft. in length, marking each end; then allow small chips to float down the stream, by one of the methods described below, noting the time required for these to traverse the distance laid off on the bank. The surface velocity in feet per second is obtained by dividing the distance in feet passed over by the float by the time in seconds it takes the float to travel this distance. The average of several such determinations will give the mean surface velocity of the stream. This result, multiplied by the coefficient 0.8, gives approximately the mean velocity.

To obtain the area of the cross-section of the stream, stretch a tape from shore to shore and take the depth of the stream at intervals of two to five feet. The average of these depths may be assumed as the mean depth of the stream. This average, multiplied by the total width, will give the cross-section of the stream in square feet.

The discharge is found by multiplying this cross-section area by the mean velocity, as obtained by the float measurements, the result giving the discharge in second-feet, or, in other words, the number of cubic feet flowing past the point of measurement each second.

In determining the velocity for small streams and when only approximate results are desired, the float is placed in the center of the stream only. For larger streams and when greater accuracy is desired, a tape is stretched across the stream and the distance between the banks is divided into a number of equal spaces or sections. Floats are then allowed to drift down the stream as near as possible in the center of each of these spaces, the same number of floats being used for each section. The mean surface velocity is then assumed to be the mean of the surface velocities obtained for the several sections. For each float the distance of its starting point from the right bank is recorded as indicated.

Jones Step Process

Since September, 1908, there has been conducted on the Michigan iron ranges, a series of experiments by John T. Jones, of Iron Mountain, Mich., having for its object the profitable treatment of low-grade iron ores of the Lake Superior iron ranges. As previously mentioned in the JOURNAL, it has been attempted to do this by bringing the ores into contact with the volatile matter of coal or wood, and likewise with the fixed carbon which is found in these fuels, it being expected that the iron oxide of the ore would be reduced, leaving the iron in a metallic condition without in any way fluxing or melting the iron or gangue found in the ore; after this it is intended by a process of magnetic concentration, to free the iron from its gangue and to obtain a product fit for blast-furnace use, and perhaps of sufficiently high grade to be acceptable for openhearth-furnace use. The process is essentially a metallizing method.

DIFFERENT TYPE OF FURNACE USED NOW

The ores principally used in making these experiments are from the Kloman mine, at Republic, Mich.; the Kloman ore is low in iron and high in silica. By the Jones process it is hoped to increase the iron content and decrease the silica content to such an extent as to make a useable product. Experiments were first made in what is known as the Ardis furnace at Iron Mountain, Mich. This furnace was a long, brick-lined steel cylinder which revolved in an inclined plane, the feed being introduced at the upper end. A plant embodying this process but of different design is now being constructed at Republic, Mich., where the Kloman mine is situated.

The plan of operation at the Kloman mine, at which the new furnaces are situated, and the later metallizing operations are described by Albert E. White, of the University of Michigan, for the Michigan Geological Survey. The following account has been abstracted from an advance publication[1] of Mr. White's chapter in the "Mineral Resources of Michigan."

The low-grade Kloman ores will be mined by the glory-hole method, hoisted and crushed in a No. 6 McCully gyratory crusher. This will pass over 1½-in. grizzlies, the oversize going to a No. 4 Gates gyratory crusher. The whole product will then pass through rolls and screens until it is broken to ⅝-in. size or smaller. This product will then be metallized in Brückner roasters, in charges of 15 tons each. These roasters are arranged in series of two. While the ore in one is being metallized, that in the other is being heated by the passing through it of the waste gases from the first roaster. The metallized product is dumped into a water-sprayed pocket. The partly disintegrated product is then treated on a jig to remove any good merchantable coke that may be present. The concentrates are conveyed to a Brückner drier, after which they are crushed to the proper size and magnetically separated into metallized ore and fine coke.

BRUCKNER ROASTERS EMPLOYED

The Brückner roasters are 18½ ft. long by 8 ft. 8 in. internal diameter. It is stated that they will require 12 hp. to start, and 5 hp. to operate when in motion. It is expected that each one will hold 15 tons of ore at a charge, and it is hoped that but four hours will be required for the metallizing operation; two being consumed in heating, and two in the reduction, or metallization. By placing them in series of two, and utilizing the waste gases, as explained above, it is hoped that a charge of 15 tons of ore will be available every two hours from the two roasters. These roasters are equipped with oil burners for giving the supplementary initial heat.

Charges of coal will be put into the roasters at the proper time for the purpose of completing the reduction of the ore. The roasters also have a 9-in. lining of firebrick, and at certain positions on the inside are placed firebrick projections to serve as lifters, for the purpose, if possible, of getting the coal underneath the ore in order that the escaping volatile gases may have an opportunity to come into as close contact with the ore as possible. The tube will revolve at varying speeds, depending upon conditions; it has a variance of from one revolution in 40 min. to 10 r.p.m. The metallizing and concentrating plant will be electrically driven throughout. The machinery includes a 200-hp. corliss engine, and a 150-kw. Western Electric alternating-current generator. It will probably be impracticable to obtain a product containing more than 85% iron, according to Mr. White, and it is said that such a product will also probably contain from 0.1 to 0.2% sulphur, and for this reason the natural outlet for the material will probably be the blast furnace.

COSTS

In obtaining the cost of $12.06 per ton of pig iron, shown in an accompanying table, it is stated that the crude ore is credited with containing but 1% of moisture, and 42% of gangue, of which 35% is silica. It is said that as 20% of the iron present is lost in the process of magnetic concentration, it will be necessary to use 2.55 tons of crude ore in order to obtain a concentrate containing 85% of iron. It is hoped that the crushing, screening, concentrating, conveying, jigging and repair costs will be materially reduced when operating on a large scale. Chicago has been assumed as the smelting center; it is expected that it will require roughly one-half ton of limestone to do the necessary fluxing. By assuming 1600 lb. of coke for a ton of silica, and 300 lb. of coke for a ton of metal, the total of 500 lb. of coke is claimed as the amount required for a ton of pig iron; 1000 lb., however, have been allowed. While some experiments have been made on other ores, both in and out of the state, present efforts are being exerted toward the problem of treating successfully the Kloman ore.

ESTIMATED COST OF TREATING LOW-GRADE KLOMAN IRON ORES

MINING AND METALLIZING

Mining	2.66 tons@$0.30	$0.798
Crushing	2.66 tons@ 0.08	0.213
Screening	2.66 tons@ 0.05	0.130
Concentrating	2.66 tons@ 0.08	0.213
Conveying	2.66 tons@ 0.10	0.266
Jigging	2.66 tons@ 0.05	0.133
Fuel		3.180
Repairs	2.66 tons@ 0.10	0.266
Tailing disposal	1.66 tons@ 0.08	0.133
Freight	1.00 tons@ 1.50	1.500
Total cost per ton of metallized product at Chicago		$6.832

SMELTING

Metallized ore	1.18 tons@$6.83	$ 8.06
Limestone	0.50 tons@ 1.00	0.50
Coke	1000 lbs. @ 4.50	2.25
Labor and repairs		1.25
Cost per ton of pig iron at Chicago		$12.06

ANALYSIS

	Crude Ore, Per Cent.	Concentrates, Per Cent.
Iron	40	85.0
Silica	35	12.5
Other gangue	7	2.5
Moisture	1	....

On Feb. 5, the Bunker Hill & Sullivan Mining & Concentrating Co. paid dividend No. 173 of $65,400. This makes a total of $13,290,450 paid in dividends.

[1] Iron Ore, Feb. 10, 1912.

American Institute Mining Engineers

The annual business meeting held in New York this week was largely attended. Action on the proposed amendments to the constitution was postponed and a resolution passed appointing Messrs. Kemp, Corning, Stone, Nichols and Ledoux a committee to study all the affairs of the Institute, their report to be considered at an adjournment of the meeting to be held on June 3, or later if necessary.

The 102d general meeting of the American Institute of Mining Engineers began on Feb. 19, at 8:30 p.m., when the meeting was called to order, in the Institute headquarters, by Benjamin B. Lawrence, chairman of the local committee. After some introductory remarks by Mr. Lawrence, Charles Kirchhoff, the retiring present of the Institute, delivered an address on "Institute Aims and Ideals." Mr. Kirchhoff was followed by Professor Kemp, who told some entertaining stories, illustrated by lantern slides. This session was held in the assembly room on the fifth floor of the Engineering Building. Upon conclusion of the speeches the members present adjourned to the headquarters of the Institute on the ninth floor, where an informal "smoker" was held. The meeting was very well attended.

The annual business meeting opened Feb. 20, at a little after 10 o'clock, there being a large attendance, undoubtedly brought out by the knowledge that differences of opinion respecting proposed amendments to the constitution of the Institute were to be exhibited at this meeting. The meeting was called to order by Dr. Douglas. After the reading of the minutes of the previous meeting, Dr. Douglas stated that there were differences of opinion respecting the proposed amendments to the constitution, as well known, but that both parties desired to unite in harmonious action (a conference having previously been held), and that in view of the circumstances it would be desirable to suspend the regular order of business. A motion to that effect was unanimously carried. Mr. Channing then introduced a resolution to the effect that Messrs. James F. Kemp, Christopher R. Corning, George C. Stone, William H. Nichols, Jr., and A. R. Ledoux be appointed a committee, with the power to fill vacancies among their number, to investigate all the affairs and the operations of the Institute and see whether an increase in dues cannot be avoided, and to report to the board of directors by May 1, 1912, making such suggestions as they may deem best for the welfare of the Institute; and that the board of directors shall cause the report of this committee to be printed and distributed by mail to each member of the Institute to the end that it may be considered and acted upon at an adjourned meeting. This resolution having been seconded, was unanimously carried.

Dr. Douglas being obliged to leave the meeting, the chair was taken by Dr. A. R. Ledoux.

By subsequent motions all of the proposed amendments now before the Institute, including the proposals to change the name, to increase the dues and to classify the membership were laid on the table, and it was voted that the adjourned meeting be held on June 3, 1912, or if it should prove inadvisable to hold it on that date that it should be held at a subsequent date, to be mutually agreed upon by the committee of investigation and the board of directors, due notice of the date to be communicated to all members of the Institute.

The next order of business being the election of three directors in the place of A. L. Walker, Joseph Struthers and Theodore Dwight, whose terms had expired, Messrs. Charles F. Rand, Edmund B. Kirby and George C. Stone were placed in nomination by the "insurgent" party, and Messrs. Walker, Struthers and Dwight were nominated as the regular ticket. Messrs. Spilsbury, Ingalls and Prof. J. W. Richards were appointed tellers to examine and report upon the proxies. They reported that George C. Stone held 869, George Otis Smith, 12, and Bradley Stoughton, 310. After the ballots had been taken, the chairman reported that 75 members had voted in person and 1191 by proxy, and that Messrs. Kirby, Rand and Stone had received 919, 927 and 926 votes, respectively; and Messrs. Dwight, Struthers and Walker, 340, 338 and 338, respectively. Upon motion by Professor Walker the election of Messrs. Kirby, Rand and Stone was made unanimous.

For officers and councillors the following ticket was nominated: James F. Kemp, president; Benjamin B. Thayer, Karl Eilers and Waldemar Lindgren, vice-presidents; Joseph W. Richards, John H. Janeway, Jr., and Sidney J. Jennings, councillors; Joseph Struthers, secretary. There were no other nominations. The entire vote of the members present in person and by proxy, 1263 in number, was cast for the ticket except the nominee for secretary, for whom the vote was smaller.

There being no further business, the meeting was then adjourned. Immediately after luncheon, which was served in the rooms of the Institute, the committee of investigation held a meeting for the purpose of organization. At 2 p.m., the members of the Institute convened for their first professional session, at which papers on fine-ore sintering and briquetting, electrostatic ore separation, and progress in roll crushing were read and discussed. In the evening there was a banquet at the Plaza Hotel; President Kirchhoff presided, the speakers being George Otis Smith, W. L. Saunders, Dr. R. W. Raymond, R. Mortimer Lamb and Col. Hay.

List of Papers

The following list of papers, the majority of which were read by title, or presented in brief oral abstract only, was announced:

"The Sintering of Fine Iron Ore," by B. G. Klugh, Birdsboro, Penn.

"Agglomeration of Fine Materials," by W. S. Landis, South Bethlehem, Penn.

"The Grondal Briquetting Process," by N. V. Hansell, New York, N. Y.

"Electrostatic Concentration or Separation of Ores," by H. A. Wentworth, Boston, Mass.

"Progress in Roll Crushing," by C. Q. Payne, New York, N. Y.

"Gold Hill Mining District in Western Utah," by Prof. James F. Kemp, New York, N. Y.

"Geology of the New Catskill Aqueduct," by Charles P. Berkey, New York, N. Y.

"Geology and Ore Deposits of the Silverbell Mining District, Arizona," by C. A. Stewart, University of Idaho, Moscow, Idaho.

"The Decomposition of Some Metallic Sulphates at an Elevated Temperature in a Current of Air," by Prof. H. O. Hofman and W. Wanjukow, Massachusetts Institute of Technology, Boston, Mass.

"Vanadium in Pig Iron," by Porter W. Shimer, Easton, Penn.

"Temperature Conversion Tables," by Dr. Leonard Waldo, New York, N. Y.

"Treatment of Copper Mine Water," by Prof. Joseph W. Richards, South Bethlehem, Penn.

"Stagnant Mine Waters," by Prof. Alfred C. Lane, Tufts College, Boston, Mass.

"Rational Valuation and Quality Efficiency of Furnace Stock," by Prof. John Jermain Porter, University of Cincinnati, Ohio.

"Bearing of the Theories of the Origin of Magnetic Iron Ores on their Possible Extent," by Frank L. Nason, West Haven, Conn.

"Geology of Harrison Gulch in Shasta County, California," by H. E. Kramm, Ithaca, N. Y.

"Direct Determination of Small Amounts of Platinum in Ores and Bullion," by F. P. Dewey, Washington, D. C.

"An Early Discovery of Fuller's Earth in Arkansas," by J. C. Branner, Stanford University, Calif.

"Occurrence of Silver, Copper and Lead Ores at the Veta Rica Mine, Sierra Mojada, Coahuila, Mex.," by Frank R. Van Horn, Cleveland, Ohio.

"A Concise Method of Showing Ore Reserves," by N. H. Emmons, Copperhill, Tenn.

"Study of Pre-Cambrian Rocks of the Harney Peak District, South Dakota," by Gordon S. Duncan, London, England.

"Treatment of Complex Silver Ore at the Lucky Tiger Mine, El Tigre, Sonora, Mex.," by D. L. H. Forbes, Toronto, Ont., Can.

"Gold in Certain Copper Alloys, Soluble in Nitric Acid," by Edward Keller, Perth Amboy, N. J.

"Electrolytic Refining of Impure Copper," by Horace H. Emrich, Kyshtim, Russia.

"Fuel Economy of Dry Blast," by R. S. Moore, New York, N. Y.

"The St. Helen's Mining District, Skamania County, Wash.," by Horace V. Winchell, Minneapolis, Minn.

"The San Nicholas Mining District," by I. H. Wentworth, Matehuala, Mex.

"Abrasion and Dust Losses in Ore Drying," by Carl F. Dietz and Dyke V. Keedy, Boston, Mass.

"The Smokeless Coal Field of West Virginia," by Edwin Ludlow, Eccles, W. Va.

"Sintering and Briquetting of Fuel Dust," by Felix A. Vogel, New York, N. Y.

"The Shumacher Briquetting Process," by Joseph W. Richards, South Bethlehem, Penn.

"Mine Lamps," by David B. Rushmore, Schenectady, N. Y.

Ductility of Zinc

Commercial zinc wires, which contain a small proportion of lead, were stretched by means of weights (W. B. Haines, *Proc.* Royal Soc., 1911, p. 526) and the elongations under various tensions and temperatures measured and calculated. It was found that at 80 to 90° C. the metal becomes remarkably soft, as much so as at 150° C. At a little above 90° a sudden hardening begins, which, however, takes some time to develop. By the time 110° is reached, the zinc is as hard as it was at 30° C., but the wire is more brittle. From 110° onward there is a regular softening as the temperature rises, up to at least 200°, and probably at least to 250° C. The effect of heating to 120° C. and then cooling, is greatly to diminish the tenacity and ductility, through the inducing of a crystalline structure, which can be destroyed by hammering. Pure zinc fails to show the changes in the region of 100° Centigrade.

Caving of the Bunker Hill Shaft, California

By L. H. Eddy

The caving of the working shaft in the Bunker Hill mine at Amador City, Calif., on Feb. 7, imprisoning 68 miners for 24 hours, without injury, was caused by the parting of the hoisting cable, which allowed a half-loaded skip to plunge from the gallows frame into the mouth of the shaft, breaking and loosening the timbers. The accident occurred at 11 o'clock in the morning, while 67 miners and the shift boss were at work, most of them in the 1750- and 1950-ft. levels. The foreman, assayer and two other men came out of the mine on the skip preceding and one miner came out on the skip that fell into the shaft; but he had stepped off at the ground floor of the gallows frame and was well out of the way.

The skips are of 2½ tons capacity, but usually carry less than a full load; and weigh about 3000 lb. each. The one which caused the damage had been hoisted to the top of the gallows frame and dumped, but the full load was not cleared, and it is believed that the extra strain of about 1000 lb. of ore remaining in the skip was partially the cause of the breaking of the cable. The break was about two or three feet from the bale; the broken end remaining on the drum was so badly frayed before the power was shut off that any wear or previously broken strands could not be seen. The skip with the other broken end was still in the shaft when I visited the mine a few days later. Mr. Hampton, the superintendent, stated that the age of the cable might have been partially the cause of the break, though it had been in use only four or five years and was not subject to extraordinary loads. The size of the cable is 1⅛ in., equal in size and strength to those used in other mines on the Mother Lode which do greater duty.

Shaft Caved for 90 Ft.

The timbers in the shaft are 14x14 in., Oregon pine, and had been in place about a year and a half; the lagging for less time. There are no unsound or rotted timbers or lagging in the shaft. But there is loose ground immediately over the shaft at the point where the first break occurred and the weight of this and the 4000-lb. weight of the skip and its half load traveling at great velocity down an incline of about 62° broke some and loosened other timbers and lagging, caving the shaft for a length of about 90 ft. The heavy iron-rail track in the floor of the shaft remained intact, but the roof and the sides were damaged.

The telephone line connecting with the underground was broken, and was not repaired till 3 o'clock in the afternoon; but communication was immediately established through the air pipe with two men who were doing repair work at the 200-ft. level. The shift boss was then called from a lower level and instructions given from the surface to send all the men up by the ladders to the 200-ft. level, where they were informed of the situation and advised that they would be released without injury and provided with what they might need. There being sufficient air for temporary needs, the blower and compressor were shut down, and the desires of the men made known. Having their noon meal in their pails, the first request was for water by the English-speaking men and for *vino* by the Italians.

A novel method of delivering the water, wine and food that supplied the men during their imprisonment was adopted. A ⅜-in. rope about 500 ft. in length, or long enough to be operated as a see-saw, was used to lower the articles, which were secured in bullion sacks attached at both ends to the middle of the rope, and sent down through a 4½-in. column pipe. Loaves of French bread, bottles of water and wine, boiled eggs, baked and boiled potatoes, an Italian sausage called *salome*, tobacco, and various articles of food, prepared by the families of the men, were sent down during the afternoon, and until 2 o'clock in the morning. Then nothing more was heard from them until 7 o'clock, when they called that they were hungry and ready for breakfast. Their hunger had been anticipated, and they were immediately supplied. During the entire imprisonment the men were cheerful, and had no doubt of quick release. They declared they were having a picnic with nothing to do but eat, drink, smoke and sleep, and enjoy the novelty of the situation.

Shaft Cleared Entirely from Above

The work of clearing the shaft from the top was begun immediately upon the men being advised of the accident; and the surface men and night-shift miners of the Bunker Hill were relieved in short shifts by men from the Fremont and other mines in the neighborhood. All the men who went into the torn shaft did so at the risk of life, but they did it voluntarily and willingly. Instructions were given the shift boss to allow no work at clearing to be done from the lower end of the fill, owing to the danger of falling débris. It required about 23 hours to clear the shaft to admit a ladder and the body of a man. Then the coming out of the men required an hour and ten minutes. Instructions were given to send up first the men who could not speak English, and to allow only five men on the ladder at one time; after there had been 12 groups of five delivered, seven were permitted to mount the ladder, the shift boss waiting until all the 67 were on the surface.

The state law requiring two openings in mines had been complied with by the

Bunker Hill in its earlier history, by means of a tunnel 1915 ft. long connecting by a 20-ft. upraise with the shaft at the 200-ft. level; but this tunnel had so long been unused, except for drainage, that it was closed to human exit. The work of clearing the tunnel had been in progress for some time under instructions of E. Hampton, who was appointed superintendent about three months ago.

The Bradley Process

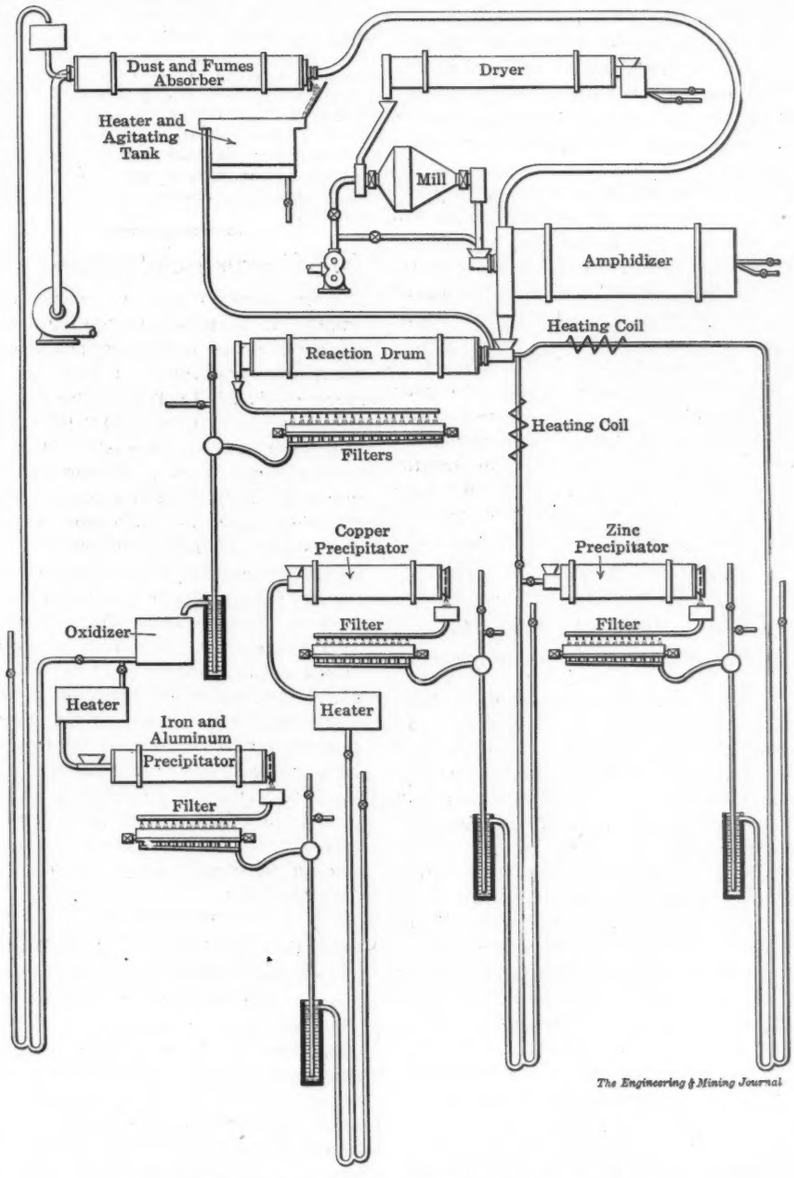
In A. L. Walker's paper on the "Metallurgy of Copper in 1911," on p. 47 of the JOURNAL of Jan. 6, 1912, the terms amphidizer and amphidization are used. In the French pat. (No. 430,692) taken out by the Bradley company, an "amphigen" is defined, according to the *Journ. Soc. Chem. Ind.*, Dec 15, 1911, as "an element which combines with the metal to form either an acid or a base," an "amphide" is "a salt of which the acidic and basic portions each contain an "amphigen," and "amphidization" is the process of producing the amphide.

It is difficult to see wherein the old terms oxygen, oxysalt, and oxidation do not meet these new demands.

The construction of the amphidizer comprises a horizontal rotating drum with a central heating flue and a burner at one end of the flue.

The ore is fed into the annular part of the drum by a screw-feed at the other end. The annular space is divided into a series of compartments by vertical partitions with inclined cross-tubes leading from one compartment to the next but one, and the arrangement is such that as the drum rotates, the ore passes towards the hot end of the drum through the first, third, fifth, etc., compartments in succession, and then passes in the reverse direction through the alternate series of compartments to a delivery orifice at the charging end. The air required for oxidation takes the same course.

In an accompanying illustration is shown the flowsheet of the Bradley process, in connection with which should be read the reference to the JOURNAL of Jan. 6, 1912, given above. The patent specification states "any gold or silver present in the solutions may be carried down during the precipitation of the iron, aluminum and copper and subsequently removed or separated therefrom, in any preferred manner known to those skilled in this art." It is understood that Mr. Bradley has developed a special process for the recovery of the gold and silver.



FLOW SHEET, BRADLEY COPPER PROCESS

De Beers Consolidated Mines

The report of the De Beers Consolidated Mines for the 12 months ended June 30, 1911, shows a total profit of £2,998,617, out of which dividends were paid at the rate of 40% on both the common and preferred shares, and £198,617 carried forward to undivided profit. The report for the year's working shows that at the De Beers and Kimberley mines the output was 0.28 carat of diamonds per load of blue ground treated; at the Wesselton mine 0.27 carat, at the Bultfontein mine 0.38 carat, and at the Dutoitspan mine 0.21 carat. There is a present stock of blue ground on hand at the various mines of 9,021,026 loads, which, at the average production per load for the last year, is equivalent to 2,373,850 carats of diamonds.

Mining and delivery of the blue ground to the washing floors costs about 76c. per load; the cost of washing is about 47c. per load, and the value of the diamonds recovered about $3 per load. No technical details of operation are given, but it is interesting to note that the Kimberley and De Beers mines up to date have produced 36,415,881 carats of diamonds. In addition to paying the dividends referred to above, final depreciation was written on the machinery and fixed plant at the mine, so that that now stands on the books at a value of £1. This is certainly conservative mining.

A number of engineers have been invited by the Bureau of Mines to be present at an explosion test, to be conducted by Chief Engineer G. S. Rice, at the experimental mine near Bruceton, Penn., on Feb. 24. There will also be a test made in the air course of a Taffanel rock-dust barrier, such as has been adopted in French mines for checking coal-dust explosions.

Ray Consolidated Quarterly Report

The second quarterly report of the Ray Consolidated Copper Co. covers the operations of the last quarter in 1911. The total underground development in both sections of the mine amounted on Jan. 1, 1912, to 158,898 ft., an increase of 22,000 ft. during the quarter. At the end of the quarter the ore blocked out ready for mining is estimated as follows: tributary to No. 1 shaft, 4,275,000 tons; tributary to No. 2 shaft, 625,000 tons. Practically all the work to be done in main development and transportation workings in both sections of the mine is finished down to the second level so that extensive development below that level will not be necessary for a number of years.

The No. 2 shaft and its equipment were not placed in operation until late in December, as the tonnage produced in the territory tributary to the shaft was not sufficiently large, up to that time, for economical operation of the hoisting machinery. At the time stated the tonnage from this section was 1000 tons per day, and it is expected this will be increased to 2000 tons daily by the end of the current quarter. The long No. 2 level connecting this shaft with the principal orebody was put through late in January and it will take about 60 days to put it in operating condition.

The rate of ore production for the quarter under discussion averaged slightly over 100,000 tons per month. Of this quantity approximately 75% came from No. 1 shaft, the remainder being taken from No. 2 shaft and the stock pile. It is estimated that the tonnage will be increased to 4000 tons daily early in March and to about 4500 tons daily near the end of that month.

Ore Averaged 1.75% Copper

The report states that the average grade for the quarter was slightly less than 1.75%. It is expected that with the increased tonnage from No. 2 shaft the grade can be maintained at 2% or better. The average cost of mining for the quarter, including crushing costs, is given at about 76c. per ton. This average includes the high cost for handling the small tonnage of ore produced in the territory tributary to No. 2 shaft and transported to No. 1 shaft for hoisting.

The mine equipment is now practically complete with the exception of a new compressor which was recently purchased. This will have a capacity of 5000 cu.ft. per min., which, together with the capacity already installed, will give a total of 13,000 cu.ft. per min. This is deemed sufficient air for a production of 8000 tons per day.

The fifth section of the mill was completed and started up early in December. In the arrangement of this section certain improvements were embodied which were suggested by the operation of the four previous units. All but one of these sections have been modified to correspond with the fifth section and the remaining section will have the necessary alterations applied by Mar. 1. Four sections were in operation most of the quarter, although not at full capacity. The machinery for the other three sections is on the ground but will not be entirely installed until a capacity exceeding 5000 tons per day is required.

The production of copper in concentrates for the quarter is reported as 7,000,000 lb., which gives a total of about 16,000,000 lb. since operations began. The percentage of recovery was comparatively low, due to frequent closing down and starting up of sections in process of alteration and to lower grade of ore treated. It is stated that now, with the plant in steady operation, an extraction of nearly 70% is being maintained. The cost of milling is given as 57c. per ton.

All concentrates were shipped to El Paso and will continue to be sent there until about the middle of February, after which they will be delivered to the new smelting plant of the American Smelting & Refining Co. at Hayden. This latter arrangement, it is stated, will result in a saving of over 1½c. per lb. because of lower freight and smelting costs.

The Chemical Duties

Washington Correspondence

The Democratic members of the Ways and Means Committee of the House have prepared a revision of the chemical schedule which radically alters rates of duty, particularly on heavy chemicals. The explosive manufacturing industry is also considerably affected by the new rates and the same is true of various other branches of the business. The bill has been ratified by the Democratic caucus and will shortly be debated and passed by the House. What will happen to it in the Senate is uncertain. Already, however, plans are spoken of for consolidating it with the pending steel bill and for passing the two as one measure. This would practically insure a Presidential veto, it is understood.

The chief significance of the new schedule is found in its radical change of classifications and arrangement of articles. On this subject the report prepared by the committee says:

> The chemical industry, on account of its importance, was in 1883 given a special schedule in the tariff, and the present classifications are, with few exceptions, the same as when the schedule was first constructed. The industry has undergone a complete transformation since 1883, and it is not surprising that the classification of items adopted more than a quarter of a century ago is found to be out of adjustment with the conditions that exist today. No consideration appears to have been given to this condition in the tariff act of 1909. Rates of duties were changed in a number of instances, but neither the arrangement nor adjustment of the classifications was seriously considered nor were the changes in rates sufficiently extensive to meet existing requirements. Moreover, the rates on a number of products were increased over those of the act of 1897. These increases appear unjustifiable from any point of view, and were neither in line with the demands for a just and equitable revision nor in the interest of effective administration. With a view to improving the antiquated condition of schedule A and of having it conform to industrial and administrative requirements, the committee has given much time to the consideration of the subject of classifications and rates and believes that the bill is, in every way, a thorough and scientific revision of the chemical schedule.

Mt. Morgan Gold Mining Co.

The report of the Mt. Morgan Gold Mining Co., operating chlorination and smelting plants at Mt. Morgan, Queensland, Australia, shows a total ore extraction of 353,571 tons in the half year ended Nov. 30, 1911. Of this 135,500 tons were rejected as waste. Four hundred and twenty tons of copper precipitate and 26,726 oz. of gold were produced by chlorination, and 3278 tons of copper and 36,471 oz. of gold by smelting.

It has been decided to try pyritic smelting in the future, and it is hoped to produce matte of converter grade from ores in one operation. It had been intended to increase the production in the half year under review, but a gas explosion in the blast main injured some of the blowers, so that there was not enough air for the extra furnace which has been erected. New turbo-blowers were expected, however, in January and March, 1912. A dividend of 5% was paid for the fiscal year, and the surplus still stands at 7.7% of the capitalization.

Austrian Mineral Production

The figures on the 1910 mineral production in Austria, given in the Journal of Dec. 23, 1911, were incorrect by the misplacement of the decimal point, and should have been as follows, the items standing in order of their value: Anthracite, 13,773,985 metric tons; bituminous, 25,132,855; iron ore, 2,627,583; silver ore, 23,629; lead ore, 22,841; quicksilver ore, 100,899; zinc ore, 34,637; graphite, 33,131; copper ore, 8005; gold ore, 31,744 metric tons. The value of Austria's total coal production was $55,937,641, and of iron ore $4,791,685.

There were produced 1,504,786 metric tons of pig iron, valued at $25,607,413; 15,476 metric tons of lead, valued at $1,138,872; 49,692 kg. of silver, valued at $876,964; 178.9 kg. of gold, $117,959; and 603 tons of quicksilver of $694,961 value.

Ore Dressing in the Joplin District—I

By James L. Bruce*

An analytical review of the ore treatment in this important zinc-lead district. The first steps in ore dressing consist of sorting on grizzlies, crushing in Blake breakers and rolls, and screening in trommels. Methods of further treatment will be described in subsequent articles.

*General manager, Continental Zinc Co., Joplin, Mo.

The importance of the industry in the zinc and lead fields of southwest Missouri, Oklahoma and Kansas is understood and appreciated only after becoming familiar with the large tonnage and value of the material handled daily. A few figures will give some idea of the consideration this industry deserves. The mining of zinc and lead ores in this district has been done by many thousands of producers; the records of ore produced and sold, especially in early days, are, even when obtainable, exceedingly unreliable. However, the figures in the accompanying table show the production by periods in Jasper, Lawrence and Newton Counties, Missouri, and in Cherokee County, Kansas, and Ottawa County, Oklahoma, taken from what I consider to be reliable sources.

PLANT OF THE CONTINENTAL ZINC CO., JOPLIN DISTRICT

LEAD AND ZINC PRODUCTION

It will probaby be a conservative estimate of the tonnage of crude ore mined, hoisted and milled to assume combined lead and zinc value averaging $2 per ton for the production prior to 1900, and $1.50 per ton for the production since then. This shows a total of 130,240,000 tons of crude ore mined and concentrated to date. During the last five years the average has been about 8,576,000 tons per year, and assuming 300 working days per year we find that the mills of the district are now handling about 28,580 tons per working day.

In the district for which these figures are given there are about 400 mills, of capacities ranging from 10 tons to 40 tons of crude ore per hour. From 30 to 50% of these mills are usually shut down, owing to unprofitable prices, exhaustion of mine, lack of development, etc., and many others operate intermittently for only two or three days a week, owing to insufficient supply of mill feed.

Most of the mills which are operated are run six 10-hour shifts per week, and probably 10 or 15% of them are run 12 ten-hour shifts per week. About 15 to 20% of this time is lost by delays for repairing machinery, etc., as practically all of the mills are built as single units and have to be entirely shut down in case any of the principal parts have to be stopped for repairs or inspection.

A POOR MAN'S CAMP

The conditions under which the district has reached its present importance are unusual. It has been preëminently a "poor man's camp," and almost every miner who has spent any number of years in it, if he has not at some time owned a prospect, has at least made some attempt to "organize a company" of the more fortunate of his acquaintances to secure a lease and try their luck at finding "diggings." This does not mean that operations have been confined to such hand-to-mouth methods, for many large stock companies have operated successfully on an extensive scale, but to the present day few land owners operate their own properties and few operators own the lands on which they operate, or even attempt to secure options to purchase the same before leasing, prospecting and developing them, and building expensive plants to operate with. Many such options could, no doubt, have been secured and would have given the operators a chance to purchase after development at a price which would have been much less than the tax levied upon them in the form of royalties.

The customary practice, which is much the same now as in earlier years, is for the operating company, either before or after organization, to secure by purchase or by direct application, a lease from the land owner. This requires the operator as a usual thing to operate continuously in a miner-like manner, and gives him the privilege of mining lead and zinc ores from a specified tract of land for a definite term of years, usually 10, in return for which the land owner who retains ownership of the ore is to pay him an agreed percentage (usually from 80 to 90%) of the returns from ore sales. Such leases are usually granted for tracts of from 5 to 20 acres, and occasionally 40 acres.

As a consequence of these conditions and also because the nature of the topography and drainage permits a fairly good mill site on almost any piece of ground most of the properties operated are comparatively small, a 40-acre tract being considered a large one for a single lease. The shallow limit of the ore (little being found below 250 ft.) makes many of the mines short-lived, compared with deep mining of other districts. The convenience with which fuel supplies, etc., can be secured, makes the average operating cost per ton of crude ore of mining and milling for several small plants not very much in excess of that for one large central plant.

The result of this situation is that there are few individual mills in the district handling over 500 tons of crude ore in 24 hours. In fact the advantages to be gained by consolidation into large properties operating in large units would be offset in a large measure by the expense and difficulty of organizing such a consolidation and by the costs of transporting the crude ore to the central milling plant and the waste material away from it.

Three Types of Ore

The ore formations occur in three general types, which may be described as runs, pockets and blankets. The ore has in all probability been deposited from solution in waters descending from the overlying Pennsylvanian measures, now pretty well removed from the district by erosion; the bodies described as "runs" being the product of circulation in underground channels of comparatively uniform width and height; those described as pockets, the product of circulation in irregular underground caverns connected by small circulating channels or feeders; the blanket formations, the result of circulation through an open or porous stratum of nearly uniform thickness and lying flat.

Coincident with such ore deposition, or nearly so, occurred the chemical or mechanical deposition of secondary flint, dolomite, selvage and soapstone. All of these, together with the chert boulders and fragments that remained undissolved in the channels and with remnants of the uncomformable overlying Pennsylvanian formation, united to fill most of the cavities and leave the orebodies which we now find.

In the run and pocket formations the "dirt" or crude ore is of two different characters, that known as "soft ground" being a heterogeneous mass of chert and lime boulders and fragments separated by mud, selvage or decomposed rock, in which the greater part of the minerals occur. These ores, when they contain much shale, mud or soapstone, present difficult crushing and screening problems. The second or hard-ground class of crude ore consists of rich pockets or disseminated deposits of mineral imbedded in the secondary flints, calcites and dolomites, which cement together the fragments and boulders of the primary rocks that the underground circulating waters have failed to erode or dissolve from the channels.

Definition of Sheet Ground

The character of ore occurring in the blanket formations is similar to that in the hard-ground pocket and run formations but one particular type, the sheet ground, is so extensive as to warrant particular description. There is some confusion regarding the use of the term "sheet ground," but a general application is to use it in referring to any ore deposit, whether sheeted or disseminated, that occurs in that part of the Mississippian formation known as the Grand Falls chert. This seems to offer the clearest distinction. The galena and blende ores in the more typical sheet ground occur in lenses or sheets between the strata of the Grand Falls chert, and are accompanied by and imbedded in a dark-colored secondary flint, which fills the interstices in the Grand Falls chert. Little sedimentary material, shales, clays, calcites, dolomites or limestone are ever found in the sheet-ground ore deposits, and the material handled is practically only galena, blende and the dark and light flint. A large part of the light flint breaks in thin flat pieces, which increases the difficulties of screening and concentrating. The gangue is exceedingly hard and cuts and abrades much more than most of the rocks from shallower depth.

Little of the lead ore of the district is intimately disseminated with either the blende or the gangue, but most of it occurs in crystals which are easily freed or isolated, in consequence of which few

PRODUCTION OF LEAD ORE (CONCENTRATE) IN SOUTHWEST MISSOURI, OKLAHOMA AND KANSAS

	Jasper		Lawrence		Newton		Cherokee		Ottawa		Total	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value
Prior to 1895	257,303	$11,708,802	31,628	$1,352,595	80,432	$3,676,632	68,573	$3,152,725	.....	.....	437,936	$19,890,754
1895–1899 inc	72,680	2,823,762	5,780	213,301	6,882	269,323	56,426	2,402,658	.....	.....	141,768	5,709,044
1900–1904 inc	111,245	5,580,578	3,218	139,935	13,372	626,804	19,941	1,039,810	150	$8,550	147,926	7,395,677
1905–1909 inc	157,661	9,896,313	1,472	93,317	10,826	693,887	14,970	1,011,406	7,824	449,992	192,753	12,144,915
Total	598,889	$30,009,455	42,098	$1,799,148	111,512	$5,266,646	159,910	$7,606,599	7,974	458,542	920,383	$45,140,390
1910	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43,685	2,234,057
1911 est	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	46,100	2,650,000
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,010,168	$50,024,447

PRODUCTION OF ZINC ORE (CONCENTRATE) IN SOUTHWEST MISSOURI, OKLAHOMA AND KANSAS

	Jasper		Lawrence		Newton		Cherokee		Ottawa		Total	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value
Prior to 1895	997,464	$21,004,789	114,414	$1,721,537	198,563	$2,286,746	303,729	$5,893,734	.....	.....	1,611,170	$30,906,806
1895–1899 inc	465,649	11,450,298	81,104	1,668,915	47,634	886,173	302,481	8,014,823	.....	.....	896,868	22,020,209
1900–1904 inc	898,202	28,161,063	76,538	2,137,137	91,707	2,267,626	161,959	4,735,641	633	$21,245	1,229,039	37,325,712
1904–1909 inc	943,103	38,760,669	63,367	2,087,346	93,429	2,777,567	169,893	7,294,757	36,592	1,256,572	1,306,384	52,176,911
Total	3,304,418	$99,379,819	335,423	$7,614,935	431,333	$8,218,112	935,062	$25,938,955	37,225	$1,277,817	5,043,461	$142,429,638
1910	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	286,381	11,817,574
1911 est	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	265,000	10,720,000
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,594,842	$164,967,212

mills have a recovery of less than 90 or even 95% of the lead contents of the "dirt" milled. The blende on the other hand may all occur intimately associated with the gangue, requiring fine crushing to release it, being in this case described as "chatty," or part of it may be quite readily freed or isolated, while the remainder is chatty, or again practically the entire blende contents may be readily freed from the gangue. Each type requires special consideration in concentrating.

Marketing the Ore

The concentrates, when put in the mill bins, are ready for marketing, and no further expense is incurred except a slight one for analyses. The various smelters purchasing zinc "ore" employ agents to buy. These agents, after buying the ore, have it loaded on wagons and weighed on custom scales or on scales furnished by the seller, then loaded into box cars and sampled with a "gun" that takes a sample in a manner similar to a cheese sampler. This is mixed and quartered down to make two or three samples, each weighing about three or four pounds, one of which is for the buyer and one for the seller, while the third, if taken, is retained for an umpire in case of disagreement. The buyer and seller each have assays made for zinc, iron and moisture, and if results check reasonably well, a settlement is made on the "split" assay or average of the two, and the seller is given a check or draft in payment.

The price is usually made by competitive bidding of the buyers, who offer the producer whatever base price they hope to purchase the ore for. The "base price" is understood to mean the price per ton of 60% zinc ore when not penalized. The "settlement price" is calculated after the ore has been loaded and assayed, and is arrived at by deducting $1 from the base price for each per cent. that the zinc of the split assay runs below 60%, or adding $1 for each per cent. in excess. From this is deducted $1 for each per cent. of iron in excess of 1%. Ores are not directly penalized for the presence of lead or lime, but an indirect penalty results from the less favorable base-price offers usually made on "leady" or "limey" ores. Many smelters will not use zinc ores that have lead contents exceeding ¼% or lime in excess of 2%. Finely ground ores, such as sludge or table ore, are less desirable and are usually sold at base prices of from $3 to $4 below the ordinary base.

Smelters Purchase Weekly

The smelters purchase weekly unless overstocked, and many of the producers sell weekly. Others, however, prefer to speculate on the market conditions at times, and often hold their ore from one to four weeks or more in hopes that general prices will be higher, competition on their class of ores keener, or because of the greater desirability of large bins of ore. History shows that the base price of ore does not bear any well defined ratio to the price of spelter, and it would appear that a base price, determined from the price of spelter with a fair and equitable treatment charge allowed the smelters and properly determined penalties for undesirable impurities, would give greater stability to prices and to the industry.

A few such contracts have been in force on the following basis: When spelter is $5 per cwt., at St. Louis, the base price to be $37. For each increase or decrease of 10c. in spelter price add or deduct 85c. per ton of concentrates. Two per cent. of iron contents allowed without penalty. From 2 to 5% iron, penalty to be $1 for each unit of iron in excess of 2%. All iron over 5% to be penalized 50c. per unit. One dollar bonus to be paid for ores containing less than 0.5% lead. Average St. Louis spelter prices of the week preceding production, as quoted by the American Metal Market, are to govern settlements.

Little Underground Night Work

As practically no underground mining of any consequence is done except on the day shift and there is a slight insufficiency of good labor even for this, it is difficult to secure good men for any special night work below the surface. On top, however, there are always men in search of jobs and this competition makes it easier to secure good men for night work in the mills, so that the efficiency of night labor for milling operations is not remarkably less than that of the day shift. As a consequence, where mining developments are extensive enough, many plants mine and hoist enough dirt on the day shift to keep the mill busy for two 10-hour shifts. In such a case "cull men" who break up the boulders that are too large to go through the grizzly, and sort out the coarser waste, are required only on the day shift. The number of men required for this purpose varies with the character of the dirt, the coarseness and hardness and whether it is muddy or not. A fair average, I think, is about one man for every 125 tons to 150 tons per shift. Thus a mill handling 500 to 600 tons in two shifts would require four or five cull men on the day shift.

In the mill itself the character of the dirt or the method of treatment determines the number of men required to properly handle it. In many of the smaller mills or mills with free ore having no concentrating table or only one table, only two men are required, the crusher feeder and the jigman who attends the jigs and tables. At larger plants equipped with from two to six tables and with a number of settling tanks, classifiers and screens which need attention, three men and sometimes four are used on each shift: One man to feed the crusher; one man for the jigs or when there are two rougher jigs and lots of repair work to be done in the mill on account of acid water or defective equipment, sometimes there is one man on the rougher jigs and one on the cleaner jig; a table man attends the tables, settling tanks, classifiers and fine screens. Thus a small 125-ton mill running single shift would require a cull man, a crusher feeder and a jig man, while a 300-ton mill if operating two shifts with bad water would require from 10 to 13 men for the two shifts. Practically all men employed are Americans and are efficient workmen. Most of them live in the nearby towns and reach their work by means of an excellent interurban electric-railway system or with horse and buggy. Few of them are members of any union.

Ore Sorted on Grizzlies

Concentration as practiced in the district may be considered as commencing when the hoisted dirt is dumped on the grizzly bars. In years past, and even now at some of the smaller mills or at custom mills, the dirt is hauled in wagons from the shaft at which it is hoisted, and dumped on a platform on a level with the crushers to which it is fed by men with shovels. At practically all of the mines of any consequence, however, the dirt is hoisted in "cans" or cars at a shaft adjacent to the storage bin and dumped on a chute which discharges directly upon the grizzly bars. These usually consist of pieces of 60- to 80-lb. rail cut 6 to 8 ft. long and laid about 5 or 6 in. apart, cut off close to the web and the tread uppermost. They are separated from one another by a rod run through the web of the rail with short pieces of pipe strung over the rod for spacers. The grizzly is supported by heavy timbers at each end. One objection to the rod and pipe for spacers is the necessity of taking the whole grizzly apart to replace one or two worn rails.

An improvement is made by using pieces of iron cast to fit between the rails. These are fastened down to the timbers by lag screws which are run through a bolt hole in the casting. Grizzlies for lighter work are made by spiking down pieces of pipe which have been flattened out at the ends. One or more cull men inspect the oversize on the grizzly, break up any which contains ore and allow it to drop through the grizzly. They load the remaining waste on a car which is then run to the waste dump. On hard, coarse dirt each man can cull from 100 to 150 tons per shift, sorting out from 5 to 15% as waste. When two or more men are at work together, a baseball mask covered with heavy screen is sometimes used as a protection against flying rock.

The dirt after passing through the grizzly bars, if not already in the mill bin, is ready for transportation to the same. This is usually accomplished in a two-ton car fitted with a door on the front end and traveling on an incline to the top of the mill hopper, where loose wheels outside the rear running wheels engage inclined guides so as to raise the rear end of the car, at the same time freeing the door and dumping the contents. This method of transporting for short distances is both rapid and cheap, seldom exceeding 1c. per ton handled. A typical car will be shown in a subsequent article. The mill bin or "hopper" is usually constructed large enough to contain dirt for a two-shift mill run and the hoppers of adjoining shafts are made large enough for one shift's hoisting, which is sent to the mill hopper toward the end of the hoisting shift.

The first cost of mill equipment and construction, disregarding hoisting engines, compressors, blacksmith shop and a proportion of the cost of power plant, etc., all of which are rightly chargeable to mining equipment, varies from $80 to $120 for each ton of capacity per 10-hour shift. This includes mill hopper, mill building, mill machinery, elevators and spouting, tailings flumes, mill ponds, etc., and a proportionate part of the cost of the power plant.

Mills Poorly Housed

The winter season is short, with only a few extremely cold snaps, and consequently little study is given to the housing of the mill; as a result the majority of the buildings are much too poorly housed in, and frozen elevator boots, settling tanks, etc., and frost-covered belting and pulleys are a source of considerable trouble. There is no doubt that the comfort and freedom from delays occasioned by better housing would in most cases much more than repay the extra cost. One item in particular that has escaped attention in almost all instances is that of collecting the leaks about the mill and running them back into the concentrating system. While many of the mills are at first so designed that there is little loss entailed by improper drainage under them, most of them later on accumulate sand piles which turn the drainage to the wrong channels and cause big losses. The best solution would seem to be a construction allowing plenty of space for arranging spouting under the mill, with a concrete floor, completely walled about, underlying the entire mill and provided with channels to carry the accumulations to elevators which would throw them back into the system.

Most of the mills are built by contractors, often from crude and incomplete specifications and drawings if indeed they have any at all, and while many of them do commendable work, others seem to be quite inconsiderate of any point except to get it done as cheaply as possible and leave the mill "in operating condition." I have seen, not one alone but many, concrete foundations built on top of grass or loose sand; knee braces for heavy mill timbers offering no more support than that offered by a few 30-penny nails driven through them, while details such as lining up shafting and blocking the journal boxes to place are seldom thought of by the contractor.

Practically all the mills are constructed of wood, or wood frame covered by galvanized iron, the principal objections to the latter being its noise and lack of protection from the cold weather. Only one steel-framed mill, that of the Mercantile Mining & Milling Co., north of Webb City, has been built, and the lack of machine-shop facilities at most of the mines would seem to preclude the advisability of steel construction. The country being so flat there is as a rule little choice in selecting a mill site. Some have made the mistake of discharging the tailings toward the lowest point adjacent to the mill, thus destroying the best natural pond and drainage collector, and making it much more difficult to save the water.

After the crude ore is in the mill bin the milling operation consists of four principal operations which will be considered in the order named: crushing; coarse concentration; fine concentration; disposition of waste.

Blake Crushers Generally Used

In the crushing department the methods employed differ much more than the types of machinery. The most general system is to crush to about two inches in a Blake-type breaker, then pass through spring rolls, elevate to a trommel screen from which the oversize goes to oversize rolls and back to the elevator again. The undersize from the screen then goes to the rougher jigs. This is varied in other plants by using a shaking screen ahead of the breaker of somewhat coarser mesh than the trommel, and running the undersize to the No. 1 elevator; or in others by omitting the No. 1 rolls and elevating direct from the breaker to the trommel and using more or larger return rolls; the elevating of this coarse material is especially hard on belts and elevator cups, however.

In still other plants the oversize is elevated by a separate elevator and sometimes returned to a second trommel the undersize from which joins the undersize from No. 1 for the rougher jig feed. In some cases the undersize from the shaker screen is run direct to the rougher jigs. In a few cases the breaker is followed by a trommel the undersize of which goes direct to the jigs, and the oversize goes to oversize rolls and is elevated to the first trommel or to a second one, the undersize of which also goes to the jigs and the oversize back to the rolls. All crushing is done wet, no dry crushing having been attempted in the district up to the present. In fact the sheet-ground ores are practically the only ones amenable to dry crushing as all others are apt to contain, at least part of the time, mud and soapstone which would clog up the breakers and rolls if crushed dry.

The shaking screen is usually made in the form of a trough from 6 to 8 ft. long, converging from about 24 in. width at the upper end to 14 or 16 in. at the lower end, inclined about 2 or 3 in. to the foot, with a sheet of perforated metal in the bottom and either swung on four rods from 4 to 6 ft. long or supported by two guide wheels on each side running on rails. It is driven from one or two eccentrics on a countershaft set at the rear of and below the frame. The use of only one eccentric causes the screen to twist and cramp the eccentric unless the screen is properly guided.

Crushers Manufactured Locally

The breakers are all of the Blake type and of local manufacture. The frame is made of a solid casting, which supports the stationary jaw, the front bumper (on which is supported the movable jaw), the eccentric, bumper and the wedge blocks for adjusting length of stroke. A breastplate of cast iron is bolted to the frame to take the wear behind the stationary jaw, and the space between is filled with babbitt metal to set it solid. To this breastplate the stationary jaw is bolted. Side plates are bolted to the frame on the inside of the opening and false removable wear plates on either side of the movable jaw. Toggle plates are made either plain or reinforced but it is advisable to use not more than one reinforced toggle plate, as the weaker one then gives a cheap breaking part in case iron gets into the breaker. The eccentric bumper is cooled by a water jacket. One and sometimes two drive pulleys and two heavy flywheels are provided and speeds range from 350 to 425 r.p.m. Sizes vary from 8x14 in. to 12x18 in. The latter is capable of crushing as much as 35 tons per hour of mixed coarse and fines to about 2-in. size.

Almost all the rolls are of local manufacture. The shells, made usually of chilled hard iron, are mounted on cast-iron cores which are keyed or pressed on shafting, and are held by a ring of shingles driven tightly between the shell and the core at each side. The driven shell is made wider and with flanges at each edge between which the narrower follower shell runs. This feature saves overflowing of the feed at the edges and relieves the roll frame of much of the shock. Shells without flanges have proven unsatisfactory on the light-framed rolls in use. The journal box of the driven shaft is rigidly supported in the frame while the box of the follower shaft is

free to slide between the way bar and the bed rail. The two shells are held together by four springs acting on each movable journal box. The pressures on two journal boxes are equalized by adjustable screws which separate the springs and the boxes. Failure to keep the adjustment equal is apt to crowd the shell to one side and break the flange off one side of the driven roll.

Roll sizes vary from 16x10 in. to 42x16 in. and speeds from 30 to 35 r.p.m. The flanged shell is driven by a gear from a countershaft supported from the roll frame. Manganese-steel and forged-steel shells have been used in place of the customary hard iron but few have found the service rendered sufficiently greater to pay for the extra cost. The hard-iron shells when worn out can be easily broken off while the steel shells often have to be burned off. This difference leaves nothing in favor of the steel shells on the score of fewer necessary changes.

Details of Elevators

Mill elevators for all except the lighter work are gear driven. The boxing is usually built outside the framework though there are some elevators lined on the inside. The latter is but little more expensive and prevents the framework cutting out and weakening the housing or becoming water soaked and warping out of shape. The housing should be wide enough to allow changes or repairs on the belt or pulleys to be quickly made. This should be about 12 in. on each side of the belt. The elevator boot should have enough depth below the feed spout to allow of taking up the belt stretch 18 in. or more without cutting the belt. The boot should be about 10 in. wider than the inside of the elevator lining so that the elevator jacks for taking up the belt stretch may be set outside the elevator housing and have their bearings on the lower pulley shaft protected from the falling sand and grit.

Almost all elevator boots are made of 1-in. boards and soon allow leakages either out of or into the elevator. This causes losses or may allow coarse material to run into sand elevators. Concrete boots with the feed coming properly in at the front of the belt would be an economical investment in nearly all instances. They would in addition provide a more stable foundation for the elevators. The elevator hood should be drawn in close to the top pulley and battered. This protects the shaft boxes and at the same time keeps the belt from running off the pulley. The hood should also be built at least 24 in. above the travel of the cups to keep material from striking the top and being thrown back on the belt. The front part of the hood should be easily removable to facilitate handling the top pulley.

Most elevators are set with the belt on a slight incline, about 1 ft. for every 10 or 12 ft. of height. This keeps the belt from flapping, prevents the necessity of taking up the belt so frequently, allows the catch box to be drawn in closer to the belt and allows the material thrown back into the elevator to fall free of the belt and lower pulley. The catch box should be within about two inches of the returning cups and down low enough so that it may be drawn well back under the discharge. It should have plenty of fall so as to carry the material away from the edge of the dump box next to the belt and should be long enough to prevent the material splashing back into the elevator. The "take up" in most common use here, and a satisfactory one, consists of a 4x6 timber set on each end of the lower pulley shaft and held in place by guides. It is lowered by means of a 2x6 or 2x8 lever over the top of it, which is held in place by a wedge.

Pulleys and Belts

Top and bottom pulleys are usually of cast iron either keyed or pressed on shafting and vary from 24 in. in diameter to 36 in. It is poor practice to use pulleys less than 30 in. diameter for 8-ply rubber or 10-ply canvas belting or heavier. Belting for the heavier service is almost all either 8-ply rubber or 10-ply stitched canvas belting. Personally I have found 10-ply rubber belting more economical than 8-ply for heavy work. The widest belts in use for elevator work are 24 in. Some belting with extra cover on one or both sides has been used but not enough to definitely either prove or disprove its economy. Elevator cups are all made locally of one piece of No. 10 or 12 sheet steel with ends lapped over and riveted. They are provided with four or more holes for bolting to the belt with either ¼- or $\frac{5}{16}$-in. elevator bolts, and the larger cups, 16 in. and upward, are usually reinforced by a brace of sheet steel between the front and back of the cup. Cups on the larger belts are spaced from 20 to 24 in. apart and are separated from the belt by means of small rectangular pieces of old belting through which the elevator bolts pass. This prevents the edge of the cup cutting the belt.

I have secured much better service from belting and less expense for elevator cups by using on 18-in. belts or wider special cups of half the belt width or a little more but of the same cross-section as the wider cups, and placed from 9 to 12 in. apart alternately against one edge and then the other of the belt. These were fastened with $\frac{5}{16}$-in. elevator bolts instead of ¼-in., the larger heads cutting the belting less. This method gives a more rigid cup, less likely to be bent and battered out of shape, and distributes the wear on the belt better, the cups wearing the belt only half way across instead of entirely across as with the larger cups. In changing cups the cups on either edge are set down or up one-fourth of the distance to another cup on the same edge.

The life of elevator cups, belts, etc., depends greatly on the speed at which they are run. Too low a speed is as detrimental as too high a speed because the cups are kept too full and the material in that event is at all times spilling out of the cups and falling back on the belt. Speeds customary in the district vary from 300 to 400 ft. per min., the slower speeds applying to the coarser and heavier material.

Trommels for Screening Jig Feed

Trommel screens for the jig feed are made by keying two or three cast-iron hubs or spiders on a piece of shafting, bolting four arms to each and mounting a circular steel band on each spider. The screen jackets are then put on over these and the ends held together by a steel drawband. Each arm is protected from wear near the screen by a small cast-iron sleeve bolted over it. The capacity of the screen may be increased from 15 to 25% by bolting three or four small angle irons to the screen jacket on the inside. The smaller trommels are made in one section from 36 to 72 in. long by 36 to 48 in. in diameter, while the larger ones are made with two sections of screen jacket overlapping 3 or 4 in. on a central support. A later article will contain a cut of the screen spider and drawband.

The usual speeds are from 25 to 30 r.p.m. The customary practice is to pass the jig feed through half-inch round perforations in sheet-steel jackets, usually of No. 8 thickness although a good many No. 6 jackets are used. Some $\frac{7}{16}$-in. and even some ⅜-in. perforations are used, the latter but seldom, however. Many of the sheets in use have fewer perforations per square foot than usually considered standard practice and have consequently longer life. The capacity, however, is limited and a larger size trommel is necessary to do the same amount of work so that the standard practice is preferable if the trommel is loaded to capacity. The slope usually given is from 1¼ to 2 in. per foot.

For a plant exceeding 20 tons per hour capacity I think the best practice is to construct the mill hopper large enough to hold without shoveling, all the dirt hoisted in 24 hours, and set sufficiently high to run the dirt over a shaking screen from which the oversize after going through the breaker joins the undersize and goes to a revolving trommel, the undersize from which is spouted directly to the jigs, the oversize dropping to oversize rolls and being elevated to the same trommel or to one set parallel with it. This practice eliminates a great deal of expensive elevating at the expense of a comparatively small increase in first cost for setting the mill hopper, breaker, etc., higher.

(To be continued)

The Electrometallurgy of Tin

In speaking of recent experiments upon the electrometallurgy of tin, *le Journal du Four Electrique* (January, 1912) reaches the conclusion that the solution of the problem has been found as regards general lines of work, and that it remains only to study the minor questions of detail. The statement is made that the yield of tin ores is much increased by electric-furnace treatment, that the process is continuous as against intermittent smelting in the reverberatory, that the formation of "hardhead" is reduced greatly, and that the quantity of carbon necessary for reduction is no more than 14% in the electric furnace, as against 20 to 25% in the reverberatory. The floor space necessary for the installation is smaller, and the consumption of the electrodes is negligible.

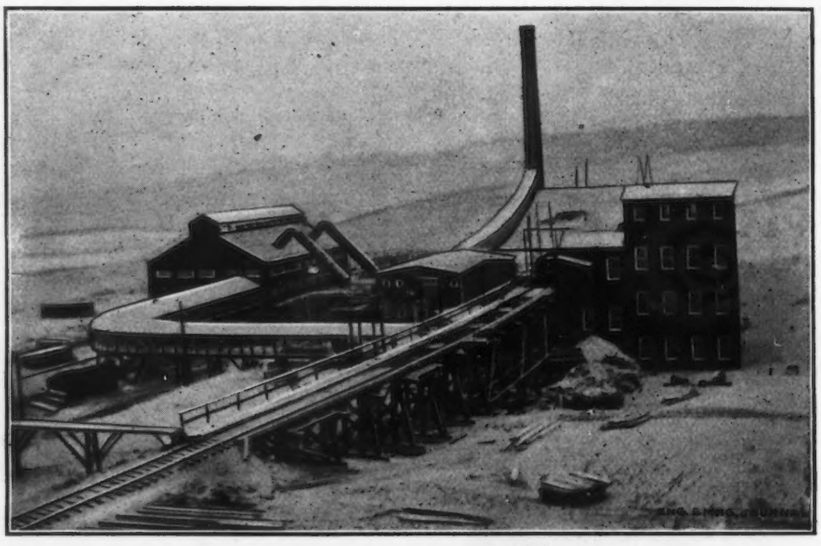
Some calculations are given as to the energy required for the reduction of cassiterite; the basis of these calculations is as follows: For the reduction of 118 grams of tin from stannic oxide, 145,300 gram cal. are required. The reaction, $C + O_2 = CO_2$, gives out 96,960 cal., and the reaction, $2C + O_2 = 2CO$, 58,000 cal. It is necessary, then, in order to set free 118 grams of tin that we should have, for the first reaction, 145,300 — 96,960 cal., or 409.661 kg.-cal. per kilogram of tin set free, and since 1 kw.-hr. equals 864 kg.-cal., it is necessary per ton of tin to have 474 kw.-hr. of energy. This figure becomes 855 kw.-hr. if we apply the equation $2C + O_2 = CO$. As in practice, each of these reactions gives about 50% of the reduction, it is necessary to count on the average as the consumption of energy required, which is 665 kw.-hr. per ton of tin. The temperature in the smelting zone is estimated at 1400 or 1500° C., and the calorific balance of the furnace is then as follows: For the reaction, 665 kw.-hr.; for heating the slag, 130; for the specific heat, 45; losses by radiation, 130; losses through hot gases, 130 kw.-hr.; a total of 1140 kw.-hr. per ton of tin.

The experiments were made in a furnace like that of Harmet for the reduction of iron ores, constructed of magnesite brick. A product was obtained containing about 99% tin, little iron, and free from arsenic. At the beginning of the campaign, which usually lasted from 10 to 12 days, the furnace was heated for a day with wood and coke in order to dry the bricks and then charged with about 14 kg. of anthracite coal per 100 kg. of ore, this proportion, however, depending on the nature of the latter. A current was then passed of about 1000 amp. at 60 v., these figures changing to 40 v. and 2500 amp. when the reaction commenced. A half-hour afterward the slag commences to form and its aspect alone suffices to show whether the charge is of the proper composition or not. Experiments have also been made to recover the tin from the furnace slags by an electrolytic method. These were fused with soda and the mass afterward dissolved in water and electrolyzed with plates of iron as a cathode. Excellent deposits of tin were obtained, but the yield was not high.

Mason Valley Smeltery, Nevada

SPECIAL CORRESPONDENCE

The Mason Valley Mines Co., on Jan. 6, blew in its first furnace at Thompson, Nev. This is the latest copper-smelting plant to commence operations in the United States, and a brief preliminary description may be of interest. The ore supply is from the company's own mines at Mason, and from those of the Nevada-Douglas Copper Co., at Ludwig, both in the Mason Valley mining district in Lyon County. The Mason Valley mines supply the sulphides, the Nevada-Douglas ores being mainly carbonate, although there is some sulphide ore in the latter mine. Both ores are nearly self-fluxing, only about 5 per cent. of lime rock being used on the charge.



FURNACE BUILDING, POWER HOUSE AND SAMPLING MILL OF THE MASON VALLEY SMELTERY, THOMPSON, NEV.

The ore is delivered to the sampling mill in 50-ton dump cars and is transferred from there to the bins on a belt conveyor. It is dropped through chutes into an automatic scale, the charge trains running underneath the scale and loading direct from them. The charge trains are made up of six cars, pulled by an electric motor.

The furnace recently blown in is of the water-jacketed drop-bottom type, 46x300 in. at the tuyeres. The furnace has 24 jackets in all, and there are 25 tuyeres on each side; the spout is at the end of the furnace and delivers into a small forehearth. From there the slag and matte flow into a larger settler, the slag being taken away by an electric motor in 20-ton slag pots. The matte is at present tapped into a casting machine of the type used at East Helena, Mont. This, however, is inadequate at times, and it is probable that a large circular settler of the usual type will be placed between the ends of the furnaces, taking the slag from two furnaces, when necessary.

At present the matte is shipped to Garfield, Utah. The plant is so designed, however, that converters can be installed without adding to the present building.

Blast is supplied by two Connersville blowers, run by electric motors, the power being obtained from two different stations, so as to avoid shutting down in case of accident to one.

The new plant started off smoothly, and for the first 10 days an average of about 350 tons of ore were smelted under low blast (20 oz.). Since then about 600 tons of ore have been smelted daily, with the blast pressure running from 30 to 35 oz. The other furnace will probably not be blown in until the full tonnage of ore is coming from the mine. The slag averages about as follows: SiO_2, 45%; FeO, 23%; CaO, 20%; Al_2O_3, 6 to 9%. The matte varies between 42 and 50%, the aim being to make always a matte over 40% copper.

The town of Thompson is built on a slope just below the smeltery and is owned by the company. There is a hotel with all modern improvements, and about 15 modern houses, seven more being under construction. Jules Labarthe is manager, and A. J. McNab is superintendent.

The Settling of Mill Slimes

By D. L. H. Forbes*

Certain standards for conducting tests are proposed which will enable operators better to predict and manufacturers to meet settling requirements. Experiments with four types of slime gave results tending to show that settling efficiency decreases as depth is increased, and that lime, cyanide and other electrolytes are accelerators.

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For the purpose of the practical mill man, slime is that portion of the crushed ore which consists of particles fine enough to overflow in his classifiers; consequently, what would be termed slime in one mill might in some other mill be considered to contain a considerable quantity of sand.

Characteristics of Slime

In the broadest meaning of the term, however, slime is a mixture of fine ore particles of varying size, physical character, and shape, such that when mixed with water or weak solutions, the particles tend to remain in suspension and maintain the character of a homogeneous liquid for an appreciable length of time. The term "colloidal" should be used only to describe the noncrystalline or amorphous slime particles, which, when mixed with water, produce a gelatinous suspension approaching in character a solution of glue or soap. Ordinary mill slime contains both colloidal and crystalline particles of clay and silica. According as the percentage of colloidal particles increases in the slime, the viscosity of the water in which it is mixed also increases, and it is well known that the rate of settlement of slime is inversely proportional to the viscosity of the water for the same temperature. It is not surprising, therefore, to find in practice that one of the elements which most influences slime settlement is the physical character of the ore and that slimes of the same relative fineness from two places may have widely differing rates of settlement.

A great amount of literature has been written on the subject of slime settlement, yet no satisfactory standards of comparison have been made for the guidance of the mill designer who must provide settling capacity for the slime based upon results obtained in existing mills treating ore which is supposed to be similar to the one with which he has to deal.

It has sometimes been noted in the case of slimes that were difficult to settle that small tests gave misleading results when applied to calculations of settling capacity in large tanks. Slime that would give several inches of clear water when settled for an hour in a 5-gal. can would be found to require a longer time to give the same depth of clear water in a large tank. The reason for this was not clearly understood and the whole subject of the settlement of slime was left obscure in so far as the intelligent prediction of results from small-scale experiments was concerned.

Tests with Four Types of Slime

Four types of slime were dealt with in the series of experiments, the results of which are given in tables Nos. 1, 2, 3 and 4. Slimes Nos. 1 and 2 contain much larger percentages of the clayey portion of the ore and the particles are relatively smaller than in slimes Nos. 3 and 4. No. 3 slime is a coarse quartz slime produced by grinding in tube mills, while No. 4 is a mixture of Nos. 2 and 3 in the proportions corresponding to the original constituents of the ore.

No. 1 slime is the overflow from Dorr thickeners and has the following characteristics: Specific gravity, 2.63; screen test—on 80 mesh, 0.3%; on 100, 1.3%; on 150, 1.3%; on 200, 0.6%; through 200, 96.5%; thickness of pulp after two days' quiet settlement, 209 grams of solids per liter; liquid, weak cyanide solution titrating 0.042% KCN.

No. 2 slime is the product of drag classifiers. Its characteristics are: Specific gravity, 2.89; screen test—on 60 mesh, 1.3%; on 80, 2.7%; on 100, 3.9%; on 150, 4%; on 200, 3.5%; through 200, 84.6%; thickness of pulp after two days' quiet settlement, 241.9 grams per liter; liquid, water with traces of sodium cyanide and lime in solution.

No. 3 is a tube-mill slime and has the following characteristics: Specific gravity, 2.75; screen test—on 80 mesh, 3.8%; on 100, 5.9%; on 150, 9.3%; on 200, 6.8%; through 200, 74.2%; thickness of pulp after two days' quiet settlement, 647.4 grams per liter, cyanide solution, 0.15% KCN and 0.09% CaO.

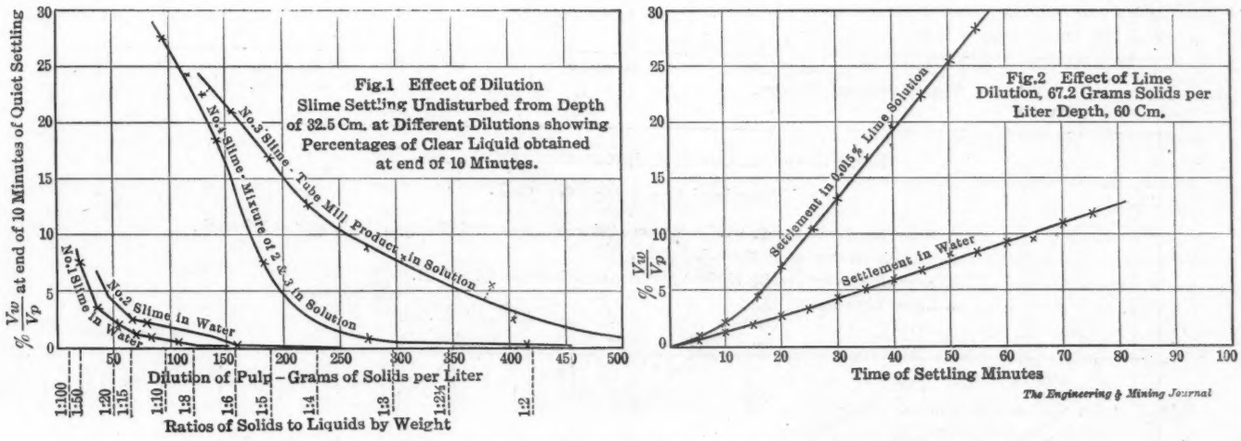


Fig.1 Effect of Dilution
Slime Settling Undisturbed from Depth of 32.5 Cm. at Different Dilutions showing Percentages of Clear Liquid obtained at end of 10 Minutes.
No.1 Slime, Mixture of 2 & 3 in Solution
No.3 Slime - Tube Mill Product in Solution
No.1 Slime in Water
No.2 Slime in Water
% Vw/Vp at end of 10 Minutes of Quiet Settling
Dilution of Pulp – Grams of Solids per Liter
Ratios of Solids to Liquids by Weight
Fig.2 Effect of Lime
Dilution, 67.2 Grams Solids per Liter Depth, 60 Cm.
Settlement in 0.013% Lime Solution
Settlement in Water
Time of Settling Minutes
The Engineering & Mining Journal

Graphical Representation of the Effect of Dilution and of Lime in Settling Slime

Since the point that interests the mill designer is the amount of settling capacity to allow for a given slime, the comparison of results is stated in terms of the volume of clear liquid divided by the total volume of the pulp expressed in per cent.

In Fig. 1 is given a graphic comparison of the behavior of the four different slimes when settling undisturbed from the same depth for 10 minutes at different dilutions. It will be seen that, in the case of slimes Nos. 1 and 2, the curves flatten out along the zero-efficiency line before the pulp has a solid to liquid ratio of 1:4, while, in the case of slime No. 4, the limit of practical settlement

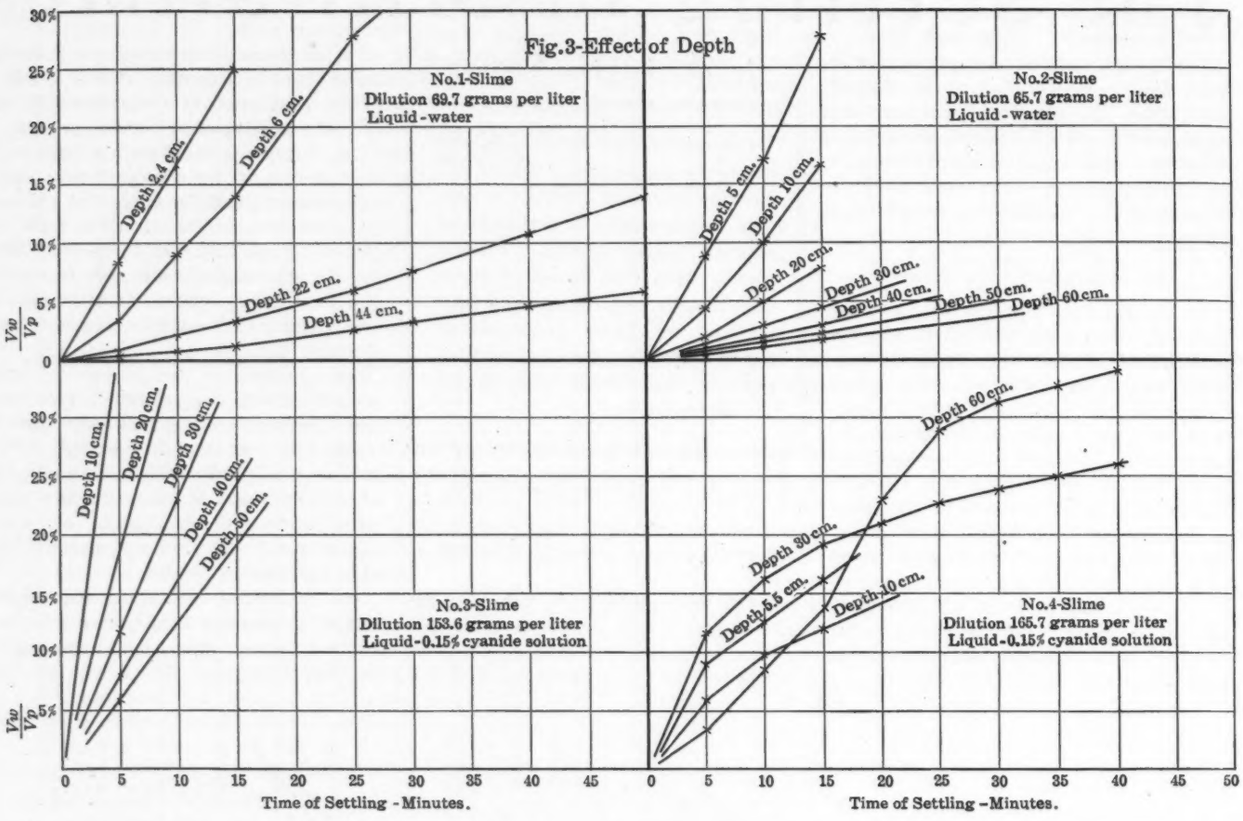


Fig.4-Scale for Grading Slimes according to Settling.

Standard Conditions for Test:

1. More than 75% of slime particles to pass a 200 mesh screen and less than 10% to stay on 100 mesh.
2. Settling column to be 30 cm. in height.
3. Average specific gravity of slime particles to be between 2.5 and 2.8.
4. Liquid to be water.

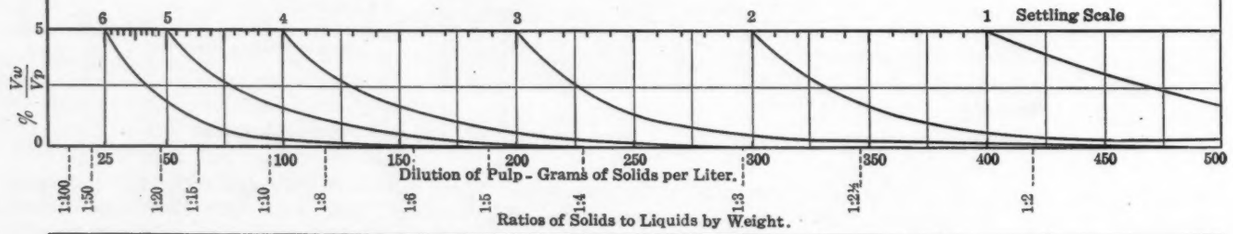


Fig.5-Scale for finding Size of Settling Tanks.

Formula:-

Required Area of Settling Tanks = $\frac{D}{d} f T N$, where T = Tonnage of Dry Slime per 24 hr. to be settled to practical limit;

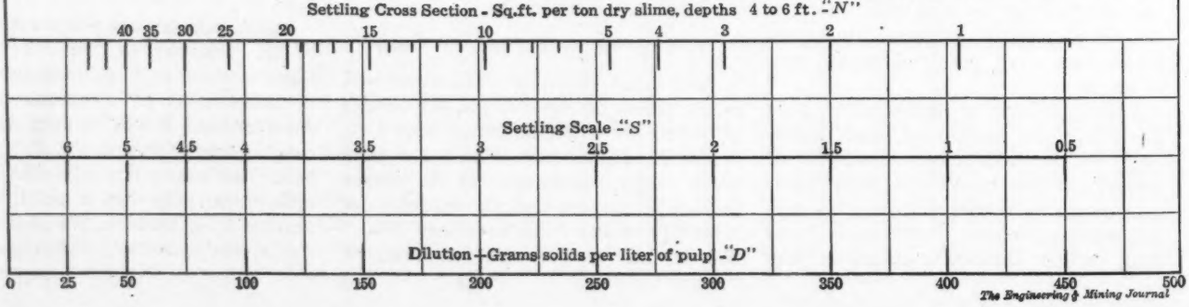
and S = Number of slime on Settling Scale;

N = Number on Settling Cross Section, vertically above S;

D = Number on Dilution Scale vertically below S;

d = dilution (in grams per liter) of pulp to be thickened;

f = experimentally determined factor for liquid used,- for slimes above 4 in settling scale, f = 0.5 app. in weak lime or cyanide solutions, for water f = 1.


Settling Cross Section - Sq.ft. per ton dry slime, depths 4 to 6 ft. - "N"
Settling Scale - "S"
Dilution - Grams solids per liter of pulp - "D"
The Engineering & Mining Journal

is reached at about 1: 1.5. With No. 3 slime on the other hand it is possible to thicken to a consistency of less than 50% moisture.

Fig. 2 shows the accelerating effect of a coagulant such as lime upon the settling of No. 2 slime. It should be mentioned in this connection, however, that the final settlement at the end of 48 hours was found to be practically the same for settling in water and for settling in 0.015% lime solution. It is well to remember that lime should never be used in large amounts for settling purposes, because an excess of lime increases the viscosity of the water and so tends to retard settling. To obtain the best efficiency in the use of lime, it should be added to the ore previous to crushing[1] so that a coating of coagulated colloids may at once form around the particles of silica and protect them from the dissolving action of the water. When the ore is crushed in water without the addition of lime or cyanide, a considerable amount of silica goes into solution in the colloidal state and the viscosity of the water is correspondingly raised.

Particular attention is called to the graphic illustration of the effect of depth, shown in Fig. 3. Slimes Nos. 1, 2 and 3 give results which plot in nearly straight lines, while No. 4 slime, which is a mixture of 2 and 3, shows considerable irregularity. In nearly every case, however, it is seen that the settling efficiency for a given dilution and time diminishes as the depth of the pulp is increased.

SETTLING TESTS ON SLIME NO. 1

Test	Position of Tube	Diameter, Mm.	Depth of Pulp, Cm.	Dilution, Grams per Liter	Mm. Depth of Clear Liquid at End of 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	$\frac{Vw}{Vp}$ % at End of 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.
1	vertical	32.5	40	209.0	0	0	0	0	0	?	0	0	0	0	0	?
2	vertical	32.5	30	167.2	0	0	0	0	?	0 5	0	0	0	0	0	0.17
3	vertical	32.5	45	104.5	1.5	2.5	4.0	7.0	11.0	14.0	0.33	0.55	0.89	1.56	2.44	3.10
4	vertical	32.5	30	83.6	1.5	3.0	5.5	9.5	14.0	17.0	0.50	1.00	1.83	3.16	4.67	5.66
5	vertical	32.5	35	69.7	2.0	4.0	..	..	..	19.0	0.57	1.15	...	...	...	5.45
6	vertical	32.5	6	69.7	2.0	5.5	8.5	..	17.0	19.0	3.34	9.20	14.12	...	28.40	31.70
7	vertical	32.5	3.3	69.7	2.0	3.0	6.0	..	..	..	6.05	9.10	18.20	...	...	....
8	vertical	32.5	2.4	69.7	2.0	4.0	6.0	..	..	..	8.35	16.70	25.00	...	...	....
9	45°	32.5	35 *	69.7	7.1	17.0	31.0	46.0	..	..	2.02	4.85	8.89	13.15	...	....
10	60° from hor.	32.5	35 *	69.7	3.5	10.5	18.5	..	..	..	1.00	4.30	5.28	...	...	....
11	30° from hor.	32.5	35 *	69.7	14.0	30.0	†	†	†	†	4.00	8.57	...	...	...	....
12	40° from hor.	32.5	35 *	69.7	9.5	26.5	†	†	†	†	2.71	7.59	...	...	...	....
13	42½° from hor.	32.5	35 *	69.7	9.0	20.8	32.5	..	..	..	2.57	5.94	9.29	...	...	....
14	vertical	32.5	35	52.2	4.5	8.5	12.0	..	..	..	1.29	2.44	3.43	...	...	....
15	vertical	32.5	32.5	34.8	6.0	12.0	18.0	..	..	..	1.84	3.69	5.53	...	...	....
16	vertical	32.5	32.5	19.0	10.0	25.0	40.0	60.0	..	..	3.08	7.69	12.70	18.90	...	....
17	vertical	32.5	32.5	9.5	indistinct	indistinct	75.0?	..	..	..	?	?	23.03	...	...	....
18	vertical	120.0	22.0	69.7	2.5	5.0	7.5	..	12.0	15.0	1.17	2.27	3.40	...	5.46	6.83
19	vertical	32.5	22.0	69.7	2.0	5.0	7.0	..	13.0	17.0	0.91	2.27	3.19	...	5.91	7.72
20	vertical	32.5	44.0	69.7	2.0	3.5	5.6	..	11.0	14.0	0.45	0.79	1.27	...	2.50	3.18

*On the incline. †Settled slime not able to gravitate.

SETTLING TESTS ON SLIME NO. 2

Test	Position of Tube	Diameter of Tube, Mm.	Depth of Pulp, Cm.	Dilution of Pulp, Grams per Liter	Mm. Depth of Clear Liquid at End of 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	$\frac{Vw}{Vp}$ % at End of 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.
1	vertical	32.5	32.5	241.9	0	0	0	0	0	0	0	0	0	0	0	0
2	vertical	32.5	32.5	161.3	0.2	0.6	1.0	1.5	....	....	0.06	0.18	0.31	0.46	.....	....
3	vertical	32.5	32.5	138.2	1.0	3.0	5.0	7.0	....	....	0.31	0.93	1.54	2.16	.....	....
4	vertical	32.5	32.5	80.6	3.5	7.0	12.0	17.0	26.0	31.0	1.07	2.16	3.70	5.25	8.00	9.54
5	vertical	32.5	32.5	65.7	4.0	8.0	12.0	....	....	....	1.23	2.46	3.70	.....	.....	....
6	vertical	32.5	32.5	52.6	5.0	12.0	18.0	30.0	....	....	1.58	3.70	5.55	9.24	.....	....
7	vertical	32.5	32.5	43.8	7.0	15.0	22.0	36.0	....	....	2.16	4.62	6.78	11.80	.....	....
8	vertical	32.5	5	65.7	4.5	8.5	14.0	....	....	....	9.00	17.00	28.00	.....	.....	....
9	vertical	32.5	10	65.7	4.5	10.0	17.0	....	....	....	4.50	10.00	17.00	.....	.....	....
10	vertical	32.5	20	65.7	4.0	10.0	16.0	.....	....	....	2.00	5.00	8.00	.....	.....	....
11	vertical	32.5	30	65.7	4.0	9.0	13.5	....	....	....	1.33	3.00	4.50	.....	.....	....
12	vertical	32.5	40	65.7	4.0	7.5	12.0	....	....	....	1.00	1.87	3.00	.....	.....	....
13	vertical	32.5	50	65.7	3.5	7.5	11.5	....	....	....	0.75	1.50	2.30	.....	.....	....
14	vertical	32.5	60	65.7	3.5	7.5	11.5	....	....	....	0.51	1.25	1.91	.....	.....	....
				Effect of Lime on Settling												
15*	vertical	32.5	60	67.2	3.0	7.0	12.0	16.0	21.0	26.0	0.50	1.17	2.00	2.67	3.50	4.33
16†	vertical	32.5	60	67.2	4.0	14.5	28.0	45.0	64.0	82.0	0.67	2.41	4.67	7.50	10.67	13.67

*With water. †With 0.015% lime solution.

[1] "The Chemical Control of Slimes," by H. E. Ashley, Trans. A. I. M. E., March, 1910.

Conditions Affecting Settling

From the results of these experiments, I am led to believe that the following conditions govern the rate of settling slime in still water: (1) The size and shape of the slime particles; (2) the percentage of colloids present; (3) the dilution of the pulp; (4) the height of the column of pulp in which settling takes place irrespective of the size or shape of the horizontal cross-section; (5) the average specific gravity of the slime particles; (6) the presence and amount of electrolytes in the water.

The size of the particles in a given slime may best be expressed by the standard screen test, noting particularly the percentage of material that will pass a 200-mesh screen. The average specific gravity of the particles will vary according as there are many or few grains of the heavy minerals present.

From the fact that depth has such an important influence on rate of settlement, it is evident that tanks as shallow as practicable should be employed, and even

in tanks two or three feet in depth, the inclined baffles advocated by Courtenay De Kalb and B. L. Gardiner as aids to settling may be used to advantage in many cases, for the inclined baffles set close together at a slope of 45 deg. constitute an apparatus in which the settling depth between each pair of baffles is only 1.414 times the space between them.

Of the six principal factors, influencing the relative settling efficiency for the same period of time, it is possible to standardize all but Nos. 1, 2 and 5 and, by specifying certain limits for size and average specific gravity, we may obtain a set of nearly standard conditions for the comparison of all mill slimes, by the observance of which the relative settling gravity of the particles to be between the limits 2.5 and 2.8.

Electrolytes—Water without the addition of lime, cyanide, alum, calcium chloride or other salts to be used for the standardization tests.

When the above standard conditions are followed in the tests, practically all mill slimes may be classified and given numbers according to their settling curves, as in Fig. 1. The dilutions are abscissas, and for ordinates the percentages of volume of clear water divided by volume of pulp at the commencement for a settling period of ten minutes are taken. Only from three to four simple experiments are needed to establish the curve for the slime in this way, and the place where

SETTLING TESTS ON SLIME NO. 3

No. of Test	Position of Tube	Diam. of Tube, Mm.	Depth of Pulp, Cm.	Dilution of Pulp, Grams per Liter	Mm. Depth of Clear Liquid at End of						$\frac{Vw}{Vp}$ % at End of					
					5 min.	10 min.	15 min.	20 min.	25 min.		5 min.	10 min.	15 min.	20 min.	25 min.	
1	vertical	32.5	32.5	512.0	1.0	2.0	3.0	....	....	....	0.31	0.62	0.92	.....	.....	....
2	vertical	32.5	32.5	409.6	2.0	9.0	20.0	....	....	....	0.62	2.77	6.15	.....	.....	....
3	vertical	32.5	32.5	384.0	4.0	17.0	33.0	43.0	....	....	1.25	5.24	10.30	13.42	.....	....
4	vertical	32.5	32.5	307.2	9.0	25.0	42.0	59.0	....	....	2.77	7.72	12.91	18.15	.....	....
5	vertical	32.5	32.5	272.5	15.0	30.0	48.0	....	....	....	4.62	9.25	14.75	.....	.....	....
6	vertical	32.5	32.5	192.0	29.0	53.0	80.0	....	....	....	8.92	16.31	24.61	.....	.....	....
7	vertical	32.5	32.5	153.6	33.0	68.0	....	....	....	....	10.30	20.95	.....	.....	.....	....
8	vertical	32.5	32.5	128.0	37.0	73.0	....	....	....	....	11.40	22.41	.....	.....	.....	....
9	vertical	32.5	5.5	153.6	26.0	29.0	....	....	....	....	47.2	52.9	.....	.....	.....	....
10	vertical	32.5	10.0	153.6	37.0	55.0	....	....	....	....	37.0	55.0	.....	.....	.....	....
11	vertical	32.5	20.0	153.6	39.0	72.0	....	....	....	....	19.5	36.0	.....	.....	.....	....
12	vertical	32.5	30.0	153.6	37.0	72.0	....	....	....	....	12.3	24.0	.....	.....	.....	....
13	vertical	32.5	40.0	153.6	33.0	66.0	....	....	....	....	8.2	16.5	.....	.....	.....	....
14	vertical	32.5	50.0	153.6	32.0	67.0	....	....	....	....	6.4	13.4	.....	.....	.....	....

SETTLING TESTS ON SLIME NO. 4

No. of Test	Position of Tube	Diameter of Tube, Mm.	Depth of Pulp, Cm.	Dilution of Pulp, Grams Solids per Liter	Mm. Depth of Clear Liquid at End of					$\frac{Vw}{Vp}$ % at End of				
					5 min.	10 min.	15 min.	20 min.	25 min.	5 min.	10 min.	15 min.	20 min.	25 min.
1	vertical	32.5	32.5	414.1	?	?	1.0	.....	.....	?	?	0.31	....	....
2	vertical	32.5	32.5	276.1	1.0	3.0	4.5	.....	.....	0.31	0.92	1.38	....	....
3	vertical	32.5	32.5	184.1	13.0	23.0	28.0	.....	.....	4.0	7.1	8.6	....	....
4	vertical	32.5	32.5	138.1	36.0	61.0	115.0	.....	.....	11.1	18.8	35.4	....	....
5	vertical	32.5	32.5	110.4	44.0	80.0	135.0	.....	.....	13.5	24.5	41.5	....	....
6	vertical	32.5	32.5	92.0	30.0	90.0	141.0	.....	.....	9.2	27.7	43.4	....	....
7	vertical	32.5	5.5	165.7	5.0	7.0	9.0	.....	.....	9.1	12.7	16.3	....	....
8	vertical	32.5	10.0	165.7	6.0	10.0	12.0	.....	.....	6.0	10.0	12.0	....	....
9	vertical	32.5	30.0	165.7	35.0	49.0	58.0	63.0	68.0	11.7	16.3	19.3	21.0	22.7
10	vertical	32.5	40.0	165.7	24.0	68.0	93.0	.....	.....	6.0	17.0	24.2	....	....
11	vertical	32.5	50.0	165.7	24.0	53.0	85.0	.....	.....	4.8	10.6	17.0	....	....
12	vertical	32.5	60.0	165.7	21.0	52.0	84.0	138.0	175.0	3.5	8.7	14.0	23.0	29.2

the curve cuts the 5% efficiency ordinate line determines its number in the settling scale, as shown in Fig. 4. The division 1 on the scale corresponds to a settling efficiency of 5% at the dilution 400 grams per liter; 2 to an efficiency of 5% at 300 grams per liter; 3 to an efficiency of 5% at 200 grams per liter; 4 to an efficiency of 5% at 100 grams per liter; 5 to an efficiency of 5% at 50 grams per liter; while 6 would correspond to an efficiency of 5% at a dilution of only 25 grams per liter.

Placed in this scale, the four slimes on which experiments were made (if the settling of all had been in water) would be numbered as follows: No. 1 slime, number in the settling scale, 5.7; No. 2 slime, 5.3; No. 3 slime, 1.4; No. 4 slime, 3. While this scale is merely an arbitrary one, it will serve approximately for predicting the settlement of mixtures of two slimes whose grades are known. No. 4 slime in Table No. 4 is a mixture of Nos. 2 and 3 in the proportions of 40% and 60%. Multiplying the settling number of each by its proportion in the mixture and adding the products, we obtain 2.96 for the estimated settling number of the mixture. No. 4 slime was found to be a trifle over 3 by plotting the curve of actual experiments.

A Useful Settling Scale

The usefulness of such a settling scale will be apparent in several ways. The manufacturer who may be called upon to furnish settling tanks for a small mining company will need only to know the settling number of the slime to be handled, and he will then be able to predict with a fair degree of accuracy to what dilution it will be possible to settle the slime. For instance, in the case of a slime whose number is 2.5, it will be possible to thicken to a dilution of about 500 grams per liter; while in the case of a slime of grade 4.5, the dilution of 300 grams per liter may be predicted as the practical limit of thickening by settling apparatus. In comparing the settling efficiency of the same slime in water with its efficiency in weak solutions of cyanide or lime, it will be safe to figure the latter

efficiency may be made to vary only in accordance with the physical character of the material dealt with.

Proposed Standardization of Tests

I would propose the following standard conditions for testing slimes:

Size—The size of the particles to be such that more than 75% of the material will pass a 200-mesh screen and less than 10% of the material will stay on a 100-mesh screen.

Dilution—The dilution of the pulp to be expressed in grams of solids per liter of pulp.

Height—All tests to be made with the pulp column 30 cm. high.

Specific Gravity—The average specific

at at least twice the former for slimes that are above No. 4 in the settling scale. For slimes that are less than 4 in the scale, the benefit of lime or cyanide will not be so great, but may be easily estimated from a set of simple experiments.

For predicting efficiencies at different depths, the safest procedure would be to make an experiment that would establish the relation between the efficiency at the standard depth of 30 cm. and that at the depth of tank that it is most practical to use.

From the experiments with slimes Nos. 2 and 3, it would appear that for small depths the efficiencies are nearly in the inverse ratio to the depth, so that a slime that would have an efficiency of 3% at a depth of 30 cm. settling for a period of ten minutes, would be expected to have only about 1% efficiency at 90 cm. depth for the same time.

In Fig. 5 are shown a formula and tentative scale, by means of which the designer may determine within the requirements of average mill practice what sizes and number of settling tanks to use for any particular case. As an example, take a mill slime that has been found by test to grade about 3.5 in the settling scale, and which has a factor of 0.8 for settling in a solution containing 2 lb. of lime per ton; required the number of square feet of tank area and the practical limit of settling, the slime to be introduced in lime solution to the tanks at a dilution of 190 grams per liter and at the rate of 80 dry tons per day. By reference to the scale, Fig. 5, we find that N corresponding to 3.5 is 15, while the corresponding D is 150, so that, using the formula,

$$Area = \frac{D}{d} fTN$$

we have required tank area equals

$$\frac{150}{190} \times 0.8 \times 80 \times 15 = 758 \; sq.ft.$$

This tank area could be given by either one circular tank 31 ft. diameter by 5 ft. deep; or two circular tanks 22x5 ft.; or three circular tanks 18x5 ft. The practical limit of thickening for this slime is found by consulting the curves in Fig. 4, and is at a dilution of from 350 to 400 grams per liter.

If the slime in the above example had been found by test to grade only 1.4 in the settling scale, the other conditions remaining the same, the required tank area would be only

$$\frac{360}{190} \times 0.8 \times 80 \times 1.8 = 218 \; sq.ft.$$

and the thickened pulp discharged from the tank would be at close to 50% moisture. One tank 16.5 ft. in diameter would in this case be sufficient.

Large deposits of coal in the department of Arauco, Chile, are announced in the *Diario Ilustrado*.

The Missing Zinc at Broken Hill

In a recent paper upon the Broken Hill ore deposits published in the *Transactions* of the Australian Institute of Mining Engineers, it was admitted that the problem of the geology of ore deposition at Broken Hill was still unsolved. This paper is discussed in the *Australian Mining Standard*, Dec. 7, 1911. This problem is one of economic as well as geological importance. To the end of 1894 the Proprietary mine extracted 2,144,000 tons of oxidized ore, which was practically free from zinc, and which was estimated to have originally contained about 600,000 tons of zinc. That these figures are practically correct seems undoubted, as it is highly improbable that this great oxidized orebody was not the result of oxidation, which would, of course, have resulted in the secondary enrichment of a primary orebody generally similar in character to the sulphide now being mined in the lower levels of the Broken Hill mine.

In the oxidation of a body of mixed galena and blende, such as the Broken Hill primary ore, the zinc would tend to dissolve before the lead and, being more readily soluble, would remain in solution longer. From this, one would expect to find an oxidized zone free of zinc followed by a zone of secondary enriched galena practically free of zinc, then a zone of secondarily enriched blende poor in lead, and, finally, the primary ore containing galena and blende. The zone of secondarily enriched galena has been found and worked, supplying large quantities of lead ore, and what is apparently primary ore is now being mined, but up to the present there have been no quantities of zinc found which would seem to account for the vast amount of zinc leached from the oxidized zone.

The subcommittee appointed by the Broken Hill Scientific Society, which compiled the paper published in the *Transactions*, seems to favor the idea that the zinc has gone into solution and been carried in this condition by surface waters below the present limit of mining. The truth of this can only be shown by extensive deep-level exploration, but it seems improbable that such extensive circulation of surface waters below the ground-water level would be possible, especially against the rising temperatures at depth.

Another theory is that the dissolved zinc may have been precipitated over a wide area, the precipitation agent not being plentiful, and so the secondary enrichment would be so widely distributed that its character would not be recognized and this secondarily enriched ore would be looked upon as primary ore. If this be true, the zinc content of the Broken Hill ore will diminish with depth. Although extensive comparisons of assays at various levels seem to show a slight decrease of the zinc content with increasing depth, the decrease hardly seems to be sufficient to account for the lost zinc by this theory of an extensively distributed secondary enrichment.

J. Bowie Wilson in his discussion of this paper in the *Australian Mining Standard* suggests that a possible solution of the problem may be the same as that which is found at Leadville; that is, that the zinc has remained in the oxidized zone to a greater extent than at present appreciated and that the resulting oxides and silicates of zinc being of an earthy and unmetallic appearance have escaped detection. While these oxides and silicates may have been looked for, there is nothing in the paper to show it, and it would be expected that some mention of it would have been made in so excellent and extensive a discussion of the Broken Hill deposit. This problem is, as said before, not alone one in geology, but is of great economic importance for the discovery of this missing 600,000 tons of zinc would undoubtedly have a stimulating effect upon mining at Broken Hill.

The Longitudinal Railway of Chile

Of general interest to investors and promoters in Chile is the new Longitudinal Railway of Chile, extending from Cabildo to Arica, and connecting with existing lines from Arica to Tacna, and Cabildo to Valparaiso. The route will lie somewhat inland, and will include a large proportion of rack line (*Engineer*, Jan. 19, 1912). The contract for the section from Copiapó to Arica was given to the Chilean Longitudinal Railway Construction Co. at £3,055,750, while the Howard Syndicate took the contract at £4,026,000 for the Copiapó-Cabildo section.

The gage is to be one meter, with a 6% grade limit on rack sections, and 3% on adhesion. The limits of curvature are 80-m. radius on adhesion lines, and 140-m. radius on rack. The chief tunnels will be at La Grupa, between Cabildo and Liniáhuida, length 1277 m.; at Las Palmas on the same section, length 1034 m.; at Las Astas on the same section, length 787 m.; and at Espino, between Illapel and San Marcos, length 1470 m. The longest bridges will be between Cabildo and Liniáhuida, one of ten 30-m. spans, and another of four 60-m. spans with an extra 30-m. opening, and one between Islon and Vallenar, of ten 30-m. spans. The total length of the new road will be about 578 km. Actual work is being done by Norton Griffiths & Co., on the south, and MacDonald, Gibbs & MacDougall on the north.

The Wizard Rock Drill

It is doubtful if any machine has been the subject of more thought and experiment and departed less from the original design than the rock drill. In 1867, the Burleigh drill was successfully used to drive the Hoosac Tunnel. It was the first practical machine in which the drill steel was fastened to the piston and cut the rock by means of percussive blows from the reciprocations of the piston. Since that time about 1500 patents have been granted for rock drills and improvements thereon, but with few exceptions, outside of those pertaining to air-hammer drills, these patents have been along the line of improvement on the general design of the first percussion piston drill. Of course, the rock drill of today is far superior to the rock drill of 40 years ago, owing to improved methods of manufacture, use of stronger and lighter materials, better workmanship with interchangeability of parts and refinements of design, but the rock drill is still notoriously inefficient as regards work done for power consumed.

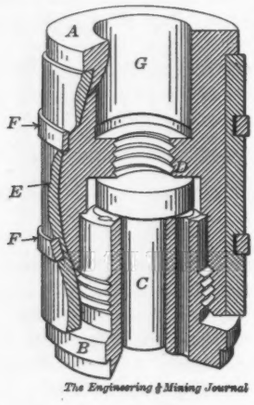


FIG. 1. DETAILS OF CUSHION VALVE

To increase the efficiency and reduce the cost of upkeep, without sacrificing any of the points of sturdiness necessary to withstand general service conditions, has been the problem of the rock-drill engineer. An interesting device has been applied recently to a rock drill of the ordinary construction, which seems from the results of tests and general service during the last year, to effect a real improvement.

An important aim in the design of all rock drills is to provide some means of preventing the head of the piston from striking the back head of the drill cylinder. In some types of drill this is accomplished by so regulating the valve motion that the admission of fluid to the upper or back face of the piston for the down or working stroke begins before the completion of the return stroke. Thus, a cushion of air between the head of the piston and back head of the drill is compressed at the final stage of the return stroke to prevent the piston from striking the back head.

The McKiernan-Terry Drill Co. has recently introduced a novel method of cushioning the return stroke by the use of a simple device that can be applied without departing from the most approved drill designs of the present time. In Fig. 2, of the accompanying illustration, this new feature is shown in section. The drill cylinder is shown at *A*, the piston at *B*, and *C* is the rifle bar with ratchet at *D*. The lower end of the rifle bar is finished as a tapering lug *E*, which engages the check valve *F*. This check valve is a piston-like device, which will be described in detail presently, that closes the upper end of the hollow piston *B*, forming a chamber *G*, known as the compression chamber. The rifle bar is bored with a central longitudinal port *I*, through which the operating fluid may pass to the compression chamber *G* from the upper end of the cylinder through *H*, a transverse port.

At the beginning of the down stroke the head of the piston is, of course, close to the back head of the cylinder. Upon admission of the fluid the piston begins to move forward from the pressure on the back of the piston and from the pressure of the fluid that passes through the transverse port *H*, down port *I*, past the valve *F* to the compression chamber *G*, where it acts upon the face *J* of the piston. The effective pressure area during the down stroke is thus increased by the area of *J*, or a little more than a square inch.

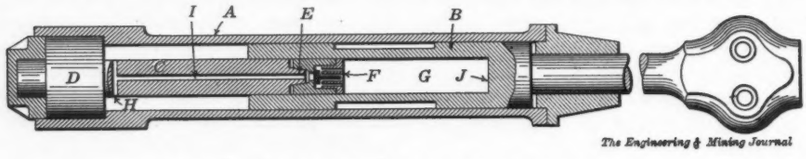


FIG. 2. DIAGRAM OF WIZARD DRILL CYLINDER

At the beginning of the return stroke the fluid in the compression chamber is compressed, the initial pressure closing the valve *F* so that no fluid can escape through the ports *H* and *I* during the return stroke. The result is that the entrapped fluid in the compression chamber *G* is gradually compressed during the return stroke. As the volume of this air gradually decreases, the pressure and temperature rise so that at about the end of the stroke the pressure in the compression chamber is so high that a large amount of the energy of the return stroke has been absorbed in compressing this fluid. This cushion of compressed fluid effectually prevents the piston from striking the back head.

In this way the admission of fluid for the down stroke can be delayed until the completion of the return stroke. Then the port opens and the working stroke is performed under pressure at the back of the piston, and the expansion of the highly compressed fluid in the compression chamber, producing a high initial velocity of the piston. Toward the end of the stroke, the valve *F* may open to admit more fluid to the compression chamber to make up for any leakage.

The introduction of this compression chamber not only effectually guards against striking the back head, but greatly accelerates the working stroke so that an unusually severe smashing blow is dealt, yet it in no way impedes the up stroke. The effect of the compression chamber is probably more pronounced when operating with air than with steam.

The check valve is shown in detail in Fig. 3, where *A* is the steel body with tapering opening *G*, which fits over the tapered end of the rifle bar and is held in place by friction. The inner portion *B* is made of steel and carries the valve *C*. The valve seat is shown at *D*. Over the steel body *A* a phosphor-bronze bushing *E* fits, which supports the two piston rings *F* that are provided to make a tight fit in the compression chamber.

The device has been tried out for a year, and it has been found that the valve is subject to little wear. Some trial runs made in New York rock, Fordham gneiss in this instance, demonstrated that the machine could outdrill some other machines of excellent manufacture and design. In drilling down holes, the superior "mudding" features were particularly notable. The mud was thrown a foot above the collar of an 18-ft. hole.

In drilling Fordham gneiss, one hole was drilled to a depth of 18 ft. in 69 min. total time, or 49 min. actual drilling time, with a 3⅝-in. machine. The next morning a 15-ft. hole was drilled in 60 min. total, or 44 min. actual time. In the afternoon one hole was drilled to a depth of 17½ ft. in 69 min. total, or 51 min. actual time, and a second hole to a depth of 18 ft. in 58½ min. total, or 42 min. actual time. The Peabody Granite & Concrete Co., of Boston, reports that in a two-month's trial in granite, the average depth drilled per hour was 5.7 feet.

The Southwestern Utahnite Safety Powder Co. has been organized at El Paso, Tex., for the manufacture of a new explosive called "Utahnite." It is claimed that the powder does not freeze, can be handled with safety, and that it shatters without scattering, a test being cited where a boulder 5x6x6 ft. was shattered in small pieces without scattering any fragments beyond a radius of 6 feet.

The California Gold Dredge—II

By Robert E. Cranston *

The mechanical features of the digging ladder and accessory parts are discussed. The plate-girder ladder is more common than the lattice type. The bucket line is gear-driven, its operation being controlled by a friction clutch and a brake wheel; an electro-magnetic clutch is preferred by the author.

*Mine manager, Ashburton Mining Co., Sacramento, Calif.

Note—An article entitled "Design and Mechanical Features of the California Gold Dredge," published in Journ. A. S. M. E., February, 1912.

The design of the digging ladder varies with the depth and nature of the ground to be handled. It is either a plate girder or a lattice girder or truss.

Plate-Girder Digging Ladder Most Used

The plate-girder type is the most common and in my opinion the best. A little weight may be saved by using the lattice type, and although it may be as strong as a plate girder, there is in the lattice type more danger of rivets working loose, causing ultimate collapse.

Ample space should be allowed under the ladder rollers, otherwise the spill from the buckets will collect and prevent the rollers turning. The ladders are made in several sections so that they may be more easily transported. Where the splices occur great care should be taken to make the joints of ample strength. I have seen several digging ladders fail and in nearly every case the failure occurred at one of the splices. In figuring the strains in a digging ladder it should be considered not only as a beam supported at two or three points, but also as a column. Where a single line is used for side swinging, the strains must also be figured for side as well as vertical stress.

At the lower end of the ladder cast-steel forks are riveted to the structural portion of the ladder. These forks are made differently by various designers, but their duty in all cases is to carry the lower-tumbler bearings and give a space for the lower tumbler to revolve in. These forks should have great lateral strength since there is a tendency to spread under the severe digging conditions. I have found it of advantage to make the inside edges of these forks fit closely to the outside of the tumbler, since if a large space is left rocks lodge and grind out both the tumbler and the forks. In my last design I have put in replaceable manganese-steel liners on the inside of the forks and hope that it will prevent much of the wear on tumbler flanges.

There are several designs of lower-tumbler bearings used. In the most common the lower portions of the forks are made to form one-half of the bearings and to this the other half is bolted. In this design a replaceable cast-iron bushing is made to fit inside the main casting, often of the self-aligning type. I have used a design similar to that of the locomotive connecting-rod end, which is fastened and adjusted by means of taper keys. The bearing is made of cast iron in two halves and slides between the upper and lower extensions of the forks. Square holes are machined through these extensions to take the keys. The half bearings are interchangeable and can be used for the upper or lower half and for either side. This style of bearing has been found very satisfactory, since it is cheap and easily replaceable.

Many attempts have been made to use protective devices for keeping grit out of the bearings, rubber, felt, brass and iron rings having been tried. The rubber and felt have been entirely discarded. Some still use bronze or iron protective rings, but they are all more bother and cause more delays than they are worth. A hole through which grease may be introduced is provided at an easily accessible place on the bearings. The grease is introduced by means of a grease gun with a screw-operated piston.

I use a lower-tumbler shaft with shallow flanges turned at either end. These flanges fit into recesses on the outside of the tumbler bearings, thus preventing the ladder forks from spreading. Where hollow shafts were used it was common practice at one time to put a rod lengthwise through the shaft, a nut at either end preventing the forks from springing apart. With the modern practice of making the lower forks extremely massive there is little danger of springing and precautions need not be taken in this direction.

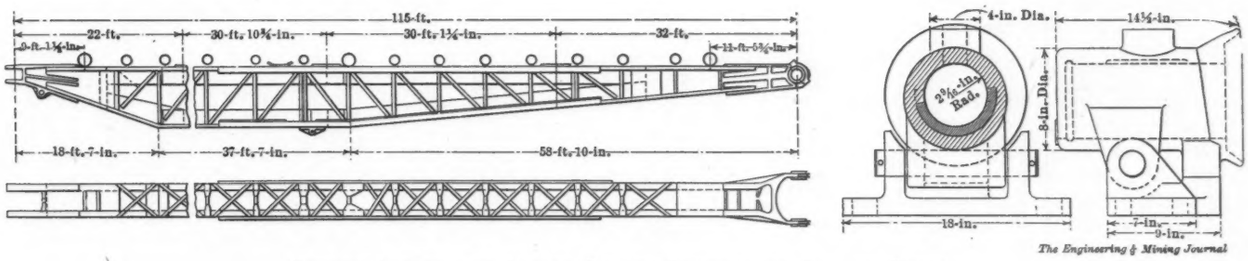
Roller Bearings Easily Removed

Spaced along the digging ladder at regular intervals are the roller bearings supported in chairs by pins which allow movement in a plane at right angles to the length of the ladder. The first bearings used were fixed rigidly and much trouble was experienced by breaking roller shafts, probably caused by movement in the ladder truss. I think it likely, with the heavier ladder construction now in vogue and the larger-sized roller shafts, that the fixed bearing would give little trouble; but even so, the present common design is better since the bearing may be quickly and easily removed, and this is a desirable feature in any part of a dredge.

The roller bearings are made with half-round bushings similar to those used in the bucket hubs. Cast iron, manganese steel and bronze are used for this purpose. Cast-iron roller bearings are being replaced by cast-steel. Where a self-adjusting bearing is used it should be supported near the middle and be of ample length; otherwise it will tend to tip down and wear out unevenly and rapidly.

In some of the dredges a pan is provided below the rollers which conveys the slop-over of the buckets to the lower end of the ladder where it will be picked up again. This is a good idea, but care should be taken to make it at least 12 in. below the rollers and in small, easily replaceable sections. If not deep enough it is likely to be a source of much annoyance by filling up and stopping the rollers, or if made in long unprotected sections it will wear out and require much work and loss of time in replacing.

The lower end of the ladder is supported at either one or two points, the



Digging Ladder and Ladder Roller Bearing for 9-cu.ft. Dredge

single suspension being used for the shorter ladders and the two-point suspension for the longer ones. Several different designs are in use, the most common being a double set of blocks, one on each side, attached to heavy forged rods or bars connecting with the ladder. Heavy chains, forged or cast links and pin links are also used. Another type has a single set of blocks attached to a cross-piece, the connection to the ladder being made from each of its ends. The attachment to the ladder is usually made by means of a cross-shaft or pin running through bearings fastened to the under side of the ladder.

Two Methods of Pivoting Ladder

The upper end of the digging ladder is pivoted either on the tumbler shaft-bearing support or on a separate mounting entirely detached from the bucket drive. By employing the first method the tumbler shaft may be used as a center and the relative position of the bucket line and upper tumbler will remain constant for all depths of digging. In the second method the pull on the bucket line will be at different angles to the position of the ladder. The first method, therefore, has a decided advantage, but it also possesses the disadvantage of preventing the easy removal of the upper tumbler and shaft, is more expensive, and in case of accident to the ladder the bucket drive may be involved through the tumbler shaft-bearing support. Massive cast-steel forks are used when the ladder is pivoted on the tumbler-bearing supports, and they should extend well down the structural part of the ladder in order to give ample space for riveting.

Along the sides of the ladder wooden chafing beams are bolted, the outer faces of which are protected by steel plates. I prefer beams put at both top and bottom of the ladder, so that they will steady it when digging hard. The beams on the ladder rub against similar ones on the sides of the well. Those in the well are put either at right angles to the ladder at intervals, or one may be placed on each side of the well parallel to the deck and on the streak above water line. If this form of chafing beam is used, both the ladder and the well beams should have beveled timbers fitted above them, so that rocks will not lodge and cause trouble when the ladder is raised or lowered. The disadvantage of placing the chafing beams at right angles to the ladder is that in case anything catches on one of them near the bottom and tears off a plate it is extremely difficult to repair, while if the beams are entirely above the water line they are easily accessible. The only disadvantage of placing them in this way is that the distance from the contact point of ladder and beam to the ladder's end is greater by the draft of the hull, and in case of side strain the bending moment is greater. Where a shore sheave is used and the end of the swinging line is attached to the lower end of the ladder there is little side strain, and in this case the horizontal wearing plates are best, in my opinion. Where a single swinging line is used, running directly to the shore, considerable side strain is exerted on the ladder, and the chafing beams at right angles to the ladder are preferable. Some designers provide rollers for the sides of the ladder, which serve the same purpose as the chafing beams.

Buckets Are Gear-driven

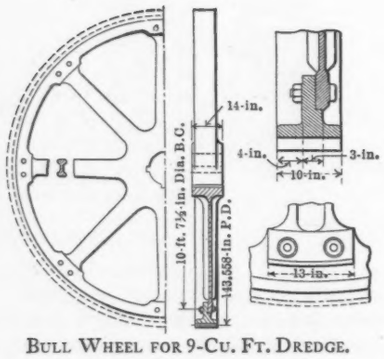
The buckets are driven by a chain of gears mounted on the main gantry. The use of a chain or shaft drive from the lower deck has now been entirely abandoned in California practice. Some dredges drive direct from the digging motor to the pulley shaft on the main gantry. Others use a countershaft on the main deck, from which also is driven the ladder hoist. Neither type has any great advantage over the other, and, if properly designed, either method will give satisfactory results.

The upper tumbler may be driven by a gear at one end of the tumbler shaft, or one at each end, with a double set of intermediate pinions, gears and pulley-shaft pinions. The single drive is, of course, cheaper and simpler, but experience has shown that after many years of service the single drive is inclined to get out of line, even when solidly built. I very much favor the double drive and would advise its use.

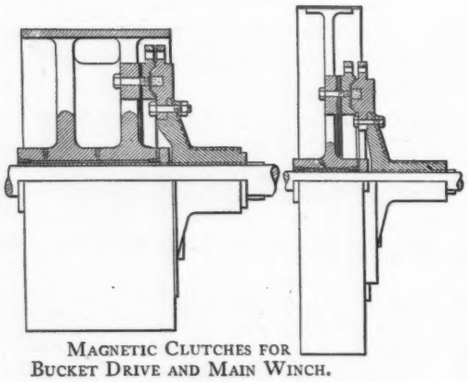
The bull wheels or tumbler-shaft gears are cast of steel in sections, sometimes with a split and sometimes with a solid hub. The rim is cast in one piece or in halves. Some designers use cut teeth, others rough cast. There can be no doubt but that the cut teeth run more smoothly, but for the rough work in hand I do not believe that the extra cost is warranted, particularly since the teeth are soon worn down and the benefit of the cut teeth disappears. In order to prevent breaking, all sharp angles should be avoided in the design of the spokes. They are subjected to constant shocks and vibration, and the gears will invariably break at a sharp reëntrant angle, should such occur at a vulnerable point. In order to make a snug fit and also to keep the rim from becoming elliptical, the spokes should either have a shoulder fitting on a machined inner edge of the rim, or the ends of the spokes should be turned to fit a machined shoulder on the rim. The latter method is preferable, since it does away with sharp corners which, as explained above, are always points of weakness.

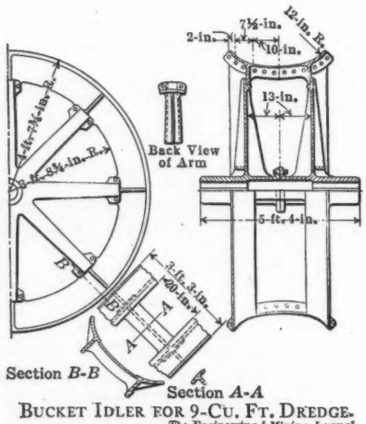
It has been common practice to use one large bolt to fasten each spoke to the rim. Two smaller bolts are better since a more even distribution of spoke cross-section can be maintained by this design and it gives a longer spoke end to bear against the machined rim. A good many spokes have been broken near the rim where the cross-section is ample but where a point of weakness exists owing to the reëntrant shoulder above mentioned.

The intermediate-shaft pinions are made solid and as small in diameter as is



Bull Wheel for 9-Cu. Ft. Dredge.


Magnetic Clutches for Bucket Drive and Main Winch.



Bucket Idler for 9-Cu. Ft. Dredge.
The Engineering & Mining Journal

consistent with good design. These pinions wear out quite rapidly and should be so arranged as to be easily replaced.

The intermediate-shaft gears are designed of a size to give the bucket line the desired speed. They are often made with separate rims so that they may be replaced when worn out without throwing away the rest of the gear.

The pulley-shaft pinions are made similar to the intermediate-shaft pinions and as small as good design will allow.

Friction Clutches Used

Whether the digging motor is belted direct to the bucket-drive pulley shaft, or to a countershaft on the ladder-hoist foundations and from there to the bucket-drive pulley shaft, some form of friction clutch is used to connect and disconnect the bucket drive, and for purposes of safety in case the buckets encounter obstructions beyond their strength. Any of the standard forms of friction clutches may be used, but I prefer the electromagnet clutch and use it in all my designs. It is by far the simplest to operate, is positive and will slip at exactly the same pull every time, according to the amount of current sent through its coil by the rheostat controlled from the pilot house.

The clutch used is simple in design. A cast-iron pulley is made so that there is a flat ring or web joining the spokes at about half the distance from hub to face. To this web is bolted a soft cast-iron ring. Between this and the pulley are inserted two thin sheets of copper and one of soft iron between the copper plates. These ring-shaped sheets are used in order to keep the lines of force where they are most wanted and to prevent the current making a permanent magnet of the pulley, shaft, etc., which would cause the clutch to drag when released. The pulley has a long hub bushed with bronze and runs free on the shaft.

A long cast-iron hub with two feather keyways at 180° and a web extending out to the same diameter as the ring on the pulley is made to slide along the shaft. To this web is bolted another soft-iron ring similar to the one bolted to the pulley. An annular groove of rectangular cross-section is machined in this ring midway between its inner and outer circumference, into which fits a coil of magnet wire. By introducing an electric current into this coil through controller rings, magnetic lines of force are induced which will draw the two soft-iron rings together, the pressure depending on the amount of current put through and the number of turns in the coil. The edges of the soft-iron rings are beveled so as to make a female joint on the pulley and a male joint on the sliding hub. The steeper the slope of these edges the less current will be required to do the requisite work, but if the cones are made too steep it will be difficult to disconnect the clutch. Forty-five degrees does very well. Good results are given by 440 turns of No. 16 magnet wire, and 4 amp. at 110 volts are put through the coil when working average ground. These figures are for a 200-hp. clutch.

The shafting for the bucket drive should be made of ample dimensions and of good material. I use nickel steel annealed and a factor of safety of 10. The gears should be fitted neatly and securely keyed. The upper tumbler-shaft bearings are made on an angle so as to have the bearing cap at right angles to the average line of pull of the bucket line. Cast-iron liners are sometimes used, but I prefer a babbitted bearing. The bearings should be well fastened so that they cannot slide forward, there being a heavy pull in this direction. These bearings, like the others of the bucket drive, are made of cast steel.

The intermediate- and pulley-shaft bearings are made of the ordinary type of babbitted base and cap, but are heavier than standard and use large-diameter bolts, which should be made of a soft grade of iron or steel, since unless this is done they are likely to crystallize and break.

It is customary to have the pulley shaft extended and a brake wheel keyed on. This brake is operated from the pilot house and is used by the winchman to hold the buckets from going over the upper tumbler when the bucket line breaks, to stop quickly in case of an accident, and to hold the bucket line when making repairs or changing buckets.

Pulleys Break near Hub

Standard Medart pulleys are generally used. They give considerable trouble on account of broken spokes. I have recently used with success a wooden bucket-drive pulley similar to that commonly employed in stamp mills, and on the last boat I designed a Medart pulley with spokes made extra heavy near the hub and tapering to a little more than standard cross-section at the rim, since nearly all the trouble arose from spokes breaking near the hub. If a cast-steel hub and spokes could be made it would be the best pulley for the purpose. Several of the steel foundries say that they would not care to attempt to cast a spider with as small spokes as the standard Medart and that a very heavy spoke would have to be made in order to overcome shrinkage trouble. If spokes could be made of cast steel and of as light or lighter design than the standard Medart it seems as if it would be an ideal pulley for dredge use.

Too much attention cannot be given to making the supports for the bucket drive of sturdy construction. In the first place these foundations are 20 or 30 ft. above the main deck and are subjected to constant and racking strains. If any portion of these supports gives, it throws the shafting out of line with obvious results. One form of support now much used and considered very good has the upper chord of the main truss made high enough to take the upper tumbler-bearing supports directly on its top. By this method the main gantry is braced fore and aft in a most excellent manner and it is a much more rigid construction than where the gentry extends above the chord. Large steel castings are used to tie the timbers together and to support the bearings directly. The details vary on different dredges and apparently have all given good service. One point which should be carefully looked into when designing this part of the dredge is so to place all bolts that they may be readily accessible and replaceable.

Where the depth of gravel to be dug demands a long string of buckets, an idler is used to support the sag. This idler is situated at the throat of the well as low down as convenient. It is made up of a cast-steel hub and a double set of spokes bolted on to a wide rim made to fit the curve of the bucket lip. The shaft is keyed to the hub and revolves in two bronze bushed bearings set on the deck or other convenient place.

Grizzlies below Dump Hopper

Below the dump hopper an inclined set of grizzly bars is put in. These extend as far forward as the sag of the buckets will allow. The bars are put ¾ to 2 in. apart. Below this grizzly is a collecting pan which directs the gravel to the forward end of a sluice with riffles, occupying the space between the gantry posts and sloping toward the after portion of the dredge. This sluice is run back as far as the grade will permit and then dumps its contents into riffled side sluices running forward one on each side of the well. These discharge into the well 15 or 20 ft. forward of the well throat. Water is furnished from one of the pumps and washes the material dropping through the grizzly bars.

The hopper into which the buckets dump diverts the gravel into the screen. It is made either with a steel lining or by having a depression left at its bottom which fills up with rocks and gravel, thus forming its own lining. It is obvious that the last method is much more economical than the steel-lined hopper and that so far as its bottom is concerned it will last indefinitely; the only difficulty is that unless the hopper is left of ample dimensions it is likely to clog up when digging large quantities of material, particularly clay. By using a steel lining for the bottom of the hopper a little space may be saved, and if a large quantity of clay is to be handled the latter method might be preferable, but for ordinary conditions the rock bottom seems to be all that is necessary.

The hopper is built up on three sides of the upper tumbler, the top being at about the level of the bucket lips as they go over the tumbler. The forward upward edge is built to such a height as to miss the bucket lips by a few inches when the ladder is in its lowest position, and it is of advantage to put inclined guide plates on each side of the bucket line to divert the slop-over of the buckets into the hopper below. The rear vertical wall of the hopper is subjected to considerable wear by the striking of the rocks and gravel against it when the buckets dump and it should be lined with an easily replaceable steel plate. A good way is to suspend a ½-in. plate from the top by means of a few bolts, leaving the bottom entirely free.

(*To be continued*)

Installations of Girod Electric Furnaces

Rubery Owen & Co., of Darlaston, England, have been granted a license for the use of the Girod electric furnace. not be divulged at this time, have also signed a contract for a Girod electric-furnace license.

Reduction of Rare Oxides

The inconvenience of attempting the reduction of oxides such as vanadium, uranium, or tungsten by means of carbon or of carbon monoxide is well known, owing to the metals having a tendency to absorb the carbon. It has also been proposed to employ calcium carbide as a reducing agent, first to avoid the contamination of the metals by carbon and also to profit by the well known properties of calcium; that is to say, the production of great heat by oxidation and the formation of a slag or scoria of energetic reducing action.

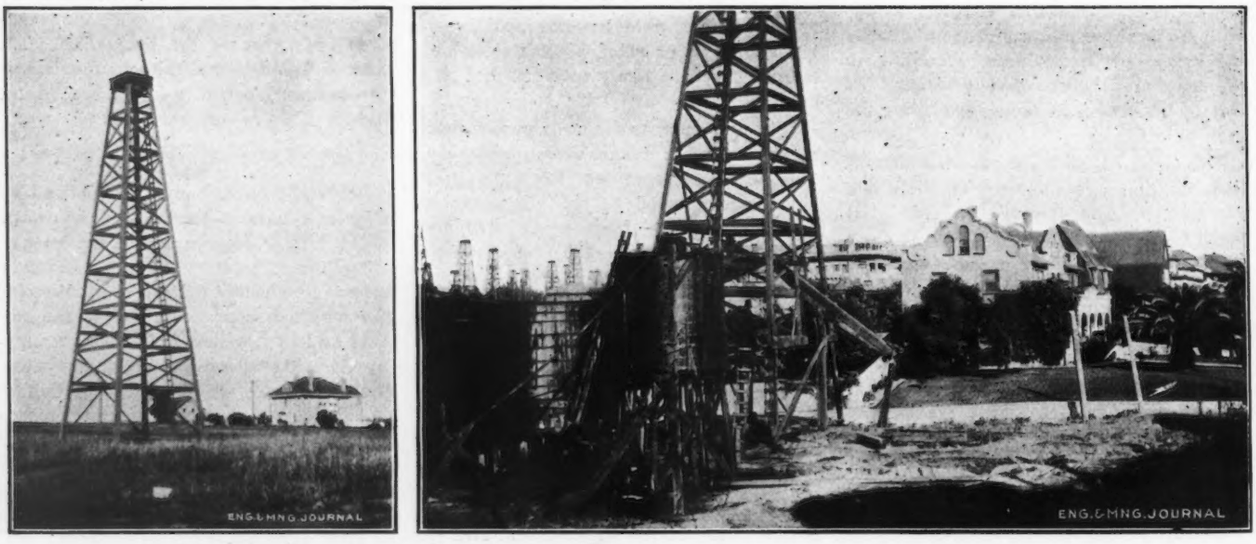
A proposed method to avoid this is given in French pat. 427,537 of the Electric Furnaces & Smelters, Ltd., in which it is suggested that the reduction be effected by means of a mixture of a carbide and a silicide. The carbide which is employed by preference is that of calcium, from tungstic acid, however, would be obtained by means of a mixture of calcium carbide and a little ferrosilicon under the action of exterior heat furnished by preference from an arc or resistance electric furnace.

Prospecting on City Lots

By C. L. EDHOLM*

A new oil derrick erected in the fashionable Wilshire Boulevard residential district of Los Angeles recalls stories we all have read about claim-jumpers in mining camps and the gun fights that followed their attempts to seize property. In this case, however, the courts will settle the claims of the disputants; on one side the owners of residential property in the best part of the city; on the other, a group of prospectors who have filed on the land in accordance with the United States mining laws and who are prospecting for oil.

The land was acquired from the Southern Pacific railroad and subdivided into



OIL DERRICKS ON RESIDENCE PROPERTY IN LOS ANGELES

The first furnace will have a capacity of three tons.

The Girod furnace is now in operation at the following works:—Simonds Manufacturing Co., at Lockport, N. Y.; S. A. E., Procedes Paul Girod, at Ugine, France; Oehler & Cie., at Aarau, Switzerland; Société John Cockerill, at Seraing, Belgium; F. Krupp & Co., Essen; Stotz & Co., at Kornwestheim, near Stuttgart; Stahlwerk Becker at Krefeld; Gutehoffnungshütte, at Oberhausen, in Germany; Ternitzer Stahlwerk, Schoeller, at Ternitz; Danner & Co., at Judenburg, in Austria; and Ungarisches Staats-Stahlwerk, at Diosgyor, in Hungary.

It is also stated that a large American steel works, whose name, and plans can-

which presents a small molecular weight in comparison with the atomic weight of the metals such as tungsten or uranium. $WO_3 + CaC_2 = W + CaO + 2CO$.

A silicide which is recommended for employment in cases where the presence of iron does not constitute a detriment is ferrosilicon. The silicide ought to be employed in the proposed mixture in proportions between 2 and 50 per cent., the proportion varying in a certain measure according to whether or not the product reduced may or may not contain a small amount of silicon. In an alloying element for armor plate, for example, a large proportion of silicon is admissible and consequently a great part of the reducing mixture would be constituted of ferro-silicon. The reduction of tungsten

lots upon some of which homes of the highest class were built. The residences in the background of the accompanying halftones are good examples of the type of houses in this part of the city. The quarter section was granted to the railroad company many years ago as agricultural land, mineral land being exempt under the provisions of the grant. The claimants therefore hold that the quarter section is Government land, open to entry for mining claims, provided mineral is found. They also state that sufficient oil has been discovered in the ground to justify them in asserting it to be mineral land. Oil fields are being exploited within a mile or so of the tract in question.

*4824 Figueroa St., Los Angeles, Calif.

Mining and Metallurgical Patents

A Classified List of New Inventions

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by The Engineering and Mining Journal upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COPPER

EXTRACTION — Improvements Relating to the Extraction of Copper from Ore Containing that Metal. W. E. Evans, Berlin, Germany. (Brit. No. 100 of 1911.)

LEACHING—Method of Extracting Copper from Calcined Ore or Slags. Antony Gadomsky. Tiflis, Russia. (U. S. No. 1,014,868; Jan. 16, 1912.)

GOLD AND SILVER

AMALGAMATOR RIFFLE. Robert L. Royse, Martinsville, Ind. (U. S. No. 1,013,066; Dec. 26, 1911.)

AMALGAMATING SYSTEM. Levi J. Kendrick and Jesse G. Tunnicliffe, Berkeley, Calif. (U. S. No. 1,013,496; Jan. 2, 1912.)

CYANIDING—Apparatus for Recovering Gold and Silver by Use of Cyanide Solutions. William L. Imlay, Philadelphia, Penn. (U. S. No. 1,014,224; Jan. 9, 1912.)

DRY CONCENTRATOR. Clarence W. Edgar, Los Angeles, Calif. (U. S. No. 1,016,680; Feb. 6, 1912.)

FILTERING APPARATUS. David J. Kelly, Salt Lake City, Utah. (U. S. No. 1,015,961; Jan. 30, 1912.)

STAMP MILL. Edmund Sheffield, Jr., Greenview, Calif. (U. S. No. 1,015,910; Jan. 30, 1912.)

STAMP SHOE. Charles L. Lawton, Hancock, Mich. (U. S. No. 1,012,664; Dec. 26, 1911.)

IRON AND STEEL

CONVERTER. Alexander Tropenas, Montelimar, France, assignor to Tropenas Converter Co., New York, N. Y. (U. S. No. 1,013,702; Jan. 2, 1912.)

CRUCIBLE FURNACES — Hoist for Crucible Furnaces. Louis Hubert John De Bats, Zelienople, Penn., assignor of one-fourth to Alfred G. Zehner, one-fourth to F. Edwin Zehner, and one-fourth to Jacob C. Milleman, Zelienople, Penn. (U. S. No. 1,013,377; Jan. 2, 1912.)

MANUFACTURE OF STEEL. William R. Walker, New York, N. Y. (U. S. No. 1,014,425; Jan. 9, 1912.)

LEAD, ZINC AND OTHER METALS

ALUMINA—Process of Producing Alumina. Edward D. Kendall, Elizabeth, N. J., assignor of one-third to E. N. Dickerson, Stovall, N. C. (U. S. No. 1,013,022; Dec. 26, 1911.)

ALUMINUM—Process of Electroplating Aluminum and Its Alloys. Ernst Becker and Otto Becker, Iserlohn, Germany. (U. S. No. 1,014,560; Jan. 9, 1912.)

LEAD—Apparatus for Separating Dross from Molten Lead. John O. Bardill, Herculaneum, Mo. (U. S. No. 1,013,635; Jan. 2, 1912.)

VANADIUM—Process of Producing Copper, Lead or Iron Vanadate from Vanadiferous Ores. Warren F. Bleecker, Boulder, Colo., assignor, by mesne assignments, to Rare Metals Mining & Milling Co. (U. S. No. 1,015,469; Jan. 23, 1912.)

ZINC—Metallurgy of Zinc. Frank Laurent Clerc, Boulder, Colo. (U. S. No. 1,012,816; Dec. 26, 1911.)

ZINC—Process of Producing Pure Zinc Sulphide and Thiosulphates. Pierre Pipereaut and Antony Vila, Paris, France. (U. S. No. 1,013,511; Jan. 2, 1912.)

ZINC-LEAD ORES—Metallurgy of Metal Sulphides. E. A. Ashcroft, Sogn, Norway. (U. S. No. 1,001,900; Dec. 19, 1911.)

NONMETALLIC MINERALS

ASPHALT—Method of and Apparatus for Treating Asphalt Oils for the Production of Asphalt and the Recovery of Lighter Products. Franklin H. Dunham, Santa Paula, Calif. (U. S. No. 1,013,283; Jan. 2, 1912.)

PHOSPHATES—Treatment of Phosphates. Nathaniel P. Pratt, Atlanta, Ga., assignor to Pratt Process Co., Atlanta, Ga. (U. S. Nos. 1,014,254 and 1,014,255; Jan. 9, 1912.)

PYRITES BRIQUET AND PROCESS of Making Same. Jacob S. Robeson, Camden, N. J. (U. S. No. 1,013,614; Jan. 2, 1912.)

MINING—GENERAL

BLASTING DEVICE. Louis E. M. Harris and Thomas S. Harris, Westernport, Md. (U. S. No. 1,015,021; Jan. 16, 1912.)

BREATHING APPLIANCE. Henry Albert Fleuss, Thatcham, and Robert Henry Davis, London, England. (U. S. No. 1,013,541; Jan. 2, 1912.)

DIAMOND DRILLING—Safety Device for Diamond-Drill-Rod Couplings. Victor Soderstrom, Virginia, Minn. (U. S. No. 1,016,106; Jan. 30, 1912.)

DRILL—Hammer Drill. William Prellwitz, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,015,509; Jan. 23, 1912.)

DRILL—Rock Drill. Robert W. Kreis, Jennings, Mo. (U. S. No. 1,012,656; Dec. 26, 1911.)

DRILL-SHARPENING MACHINE. James W. Coyle, Carterville, Mo., assignor of one-half to W. A. Cristy, Joplin, Mo. (U. S. No. 1,016,551; Feb. 6, 1912.)

DRILLS—An Improved Bushing Extractor for Rock Drills and the Like. Chris. Jensen, Nelson, B. C., Canada. (Brit. No. 4601 of 1911.)

DRILLS—Engine for Rock Drills. Benjamin Hastings, Barberton, Ohio. (U. S. No. 1,015,798; Jan. 30, 1912.)

DRILLS—Improvements in and Relating to Coal and Rock Drills. Pryce Davies, Hengoes, South Wales, Eng. (Brit. No. 19,620 of 1911.)

DRILLS—Improvements in Rock Drills. Ingersoll-Rand Co. New York. (Brit. No. 17,415 of 1911.)

DRILLS—Improvements Relating to Rock Drills. G. H. Rayner, Abbeydale, Eng. (Brit. No. 231 of 1911.)

HOISTING—Mine-Carriage and Elevator Automatic Safety Brake. Gerrit Von Daam, Scranton, Penn. (U. S. No. 1,016,114; Jan. 30, 1912.)

LAMP—Hydrocarbon Miner's Lamp. Jules Goulet, Brussels, Belgium. (U. S. No. 1,013,765; Jan. 2, 1912.)

MINE CAR. James M. Cook, Westmont Borough, Penn. (U. S. No. 1,012,817; Dec. 26, 1911.)

MINE-CAR WHEEL. John S. Skelly, Monongahela, Penn. (U. S. No. 1,015,351; Jan. 23, 1912.)

MINE-DOOR OPERATOR. Pliny Mace, Irwin, Penn. (U. S. No. 1,014,886; Jan. 16, 1912.)

PUMPS—Automatic Valve for Mine Pumps. William F. Maddox, Linton, Ind. (U. S. No. 1,016,573; Feb. 6, 1912.)

SHAFTS—Method of Sinking, Lining and Cementing Shafts. Paul Albert Legrand, Brussels, Belgium. (U. S. No. 1,014,656; Jan. 16, 1912.)

ORE DRESSING—GENERAL

CLASSIFIERS—Improvements in Ore Classifiers. Compagnie d'Entreprises de Lavage de Minerais, Paris, France. (Brit. No. 18,453 of 1911.)

CONCENTRATING TABLE. William L. Muender, Montford, Wis. (U. S. No. 1,015,823; Jan. 30, 1912.)

CONCENTRATION—Ore-Concentrating Machine. Orrin H. King, Chicago, Ill., assignor to United States Concentrating Co. (U. S. No. 1,014,327; Jan. 16, 1912.)

CONCENTRATION AND CLASSIFICATION—Apparatus for the Wet Dressing of Sulphide Ores. Benjamin Sedgely Smith, Manly, near Sydney, N. S. W., Australia. (U. S. No. 1,014,977; Jan. 16, 1912.)

CONCENTRATOR—Ore Concentrator. Ira F. Monell, Boulder, Colo. (U. S. No. 1,013,205; Jan. 2, 1912.)

CONCENTRATORS—Improvements in Ore Concentrators. Behrend Concentrators Co., New York, N. Y. (Brit. No. 1829 of 1911.)

CRUSHER. Thomas Leggett Sturtevant, Quincy, and Thomas Joseph Sturtevant, Wellesley, Mass., assignors to Sturtevant Mill Co. (U. S. No. 1,013,459; Jan. 2, 1912.)

CRUSHER PLATE. Ferdinand Mora Canda, New York, N. Y., assignor to Chrome Steel Works, Chrome, N. J. (U. S. No. 1,015,871; Jan. 30, 1912.)

CRUSHING MACHINE. Edgar B. Symons, Milwaukee, Wis. (U. S. No. 1,013,626; Jan. 2, 1912.)

QUARTZ MILL. Samuel S. Jennison, Cleveland, Ohio, assignor to Denver Quartz Mill & Crusher Co., Denver, Colo. (U. S. No. 1,014,305; Jan. 9, 1912.)

SEPARATION—Liquid Ore Separation. Francis I. du Pont, Wilmington, Del. (U. S. No. 1,014,624; Jan. 9, 1912.)

METALLURGY—GENERAL

ARSENATE OF LEAD—Method of Manufacturing Arsenate of Lead. Edwin O. Barstow, Midland, Mich., assignor to Dow Chemical Co., Midland, Mich. (U. S. No. 1,014,742; Jan. 16, 1912.)

BRICK FOR METALLURGIC FURNACES. William N. McKnight and Robert H. Youngman, Pittsburg, Penn., assignors to Harbison-Walker Refractories Co., Pittsburg, Penn. (U. S. No. 1,016,350; Feb. 6, 1912.)

CHARGING FURNACES — Apparatus for Charging Furnaces. David Baker, Philadelphia, Penn. (U. S. No. 1,016,539; Feb. 6, 1912.)

ELECTRIC FURNACE. Francois Louvrier, Mexico, Mexico. (U. S. No. 1,013,189; Jan. 2, 1912.)

ELECTRIC FURNACES — Improvements in Electric Metallurgical Furnaces. Victor Stobie, Sheffield, Eng. (Brit. No. 674 of 1911.)

FURNACE JACKET. Charles A. Fischer, Chicago, Ill., assignor to Allis-Chalmers Co., Milwaukee, Wis. (U. S. No. 1,012,831; Dec. 26, 1911.)

FURNACES—Improvements in or Relating to Furnaces for Smelting Metals or the Like. F. W. Winner, Wiesbaden, Germany. (Brit. No. 10,939 of 1911.)

MELTING FURNACE. Willis W. Case, Denver, Colo.; Nettie J. Case, administratrix of said Willis W. Case, deceased. (U. S. No. 1,013,838; Jan. 2, 1912.)

METALLURGICAL FURNACE. John R. Moffit, Denver, Colo.; Eugenia A. Moffitt, Denver, Colo., administratrix of said John R. Moffitt, deceased. (U. S. No. 1,014,971; Jan. 16, 1912.)

REDUCTION—Process for the Reduction of Ores. William Koehler, Cleveland, Ohio. (U. S. No. 1,013,498; Jan. 2, 1912.)

RETORT FURNACES—Mixing the Heating Gases and Combustion Air in Retort Furnaces and the Like. Ofenbau-Gesellschaft m. b. H., Munich, Germany. (Brit. No. 15,287 of 1911.)

ROASTING FURNACES — Improvements in or Relating to Mechanical Roasting Furnaces. K. J. Beskow and A. Ranen, Helsingborg, Sweden. (Brit. No. 12,214 of 1911.)

SMELTING FURNACE, with Electric Refining Hearths Connected Thereto. Alois Helfenstein, Vienna, Austria-Hungary. (U. S. No. 1, 015,439; Jan. 23, 1912.)

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Herbert C. Enos has returned to the city of Mexico, after examining mines in Guerrero.

W. L. Saunders, president of the Ingersoll-Rand company, has returned from a trip around the world.

Rensselaer H. Toll, of Denver, is at Mineral Hill, Nev., completing the Mineral Hill Consolidated mill.

J. H. Hodgson, mining engineer of London, Eng., is making an inspection of the Porcupine region in Ontario.

C. W. Botsford, mining engineer for a New York corporation, is looking over the Magdalena district in New Mexico.

W. E. Corey has been elected a director of the International Smelting & Refining Co., in place of Adolph Lewisohn, retired.

Information is sought of Charles Henley, a mining engineer, whose last known address—about five years ago—was Hillside, Arizona.

D. C. Jackling, of Salt Lake City, has been chosen a director of the Butte & Superior Copper Co. in place of J. B. Becher, retired.

Carl A. Allen, assistant professor of mining at the Colorado School of Mines, spent a few days in the Trinidad, Colo., coalfields recently.

George W. Schneider, professor of mining at the Colorado School of Mines, recently examined mining properties near Washington, D. C., in Maryland.

A. Jarman, recently professor in University College, Auckland, N. Z., has been appointed assistant general manager of the Waihi Grand Junction mine at Waihi, New Zealand.

John W. Skeele, for some years past vice-president of the Lehigh Valley Co., has been chosen president of the new Lehigh Valley Coal Sales Co. George N. Wilson is vice-president.

C. W. Saxman, formerly mechanical engineer of the Latrobe-Connellsville Coke Co., has been elected general manager of the Copper Reef Consolidated Mining Co. at San Carlos, Arizona.

Ernst Sjöstedt, of Sault Ste. Marie, Canada, is making a three-months' trip in Europe, partly on business, partly on pleasure, and partly to study the present status of electric smelting in Europe.

H. Ives, who has been manager of the Platteville, Wis., office of the Galena Iron Works, has resigned to accept a position as general purchasing agent for the American Zinc & Lead Co., with office at St. Louis.

J. S. Dennis, of Calgary, Alta., has been appointed head of the new Department of National Resources of the Canadian Pacific Ry., which includes the charge of the company's coal mines and coal lands in western Canada.

J. C. Maben, Sr., president of the Sloss-Sheffield Steel & Iron Co., after spending several weeks in Birmingham, Ala., in the general offices of the company, has returned to New York, where he has taken up his residence.

James Bowron has been elected president of the Southern Iron & Steel Co. He has been vice-president and general manager of the company for several months. He was at one time treasurer of the Tennessee Coal, Iron & R.R. Co., and has been connected with coal and other corporations in the Birmingham district.

W. H. Cunningham, general manager, and C. R. Conner, manager of mines of the West Kentucky Coal Co., Sturgis, Ky., resigned Feb. 1, and have formed a copartnership as consulting and contracting engineers, with offices in the Robeson-Prichard Building, Huntington, W. Va., and the Blackstone Building, Ashland, Kentucky.

OBITUARY

Amasa B. Campbell died at Spokane, Wash., Feb. 17, aged 67 years. He was well known as a mine owner and operator in Washington, Idaho and British Columbia.

Oliver Hart, engineer, fell to the bottom of the shaft of the Last Chance mine in the Nashville district near Eldorado, Calif., on Jan. 31. His body was recovered later, after the water had been pumped from the shaft.

Solomon Brisacher died at Salt Lake City, Utah, Feb. 11, aged 75 years. He was born in Germany, but came to this country when a child. He settled in Utah in 1885, and engaged in business there. Later he became owner of mining properties in Utah and Nevada and was considered wealthy until five years ago, when he lost heavily in Goldfield and other Nevada mines.

Llewellyn W. Johns, formerly general mining superintendent of the DeBardeleben Coal, Iron & Railroad Co., died Feb. 4, at his home at Birmingham, Ala., aged 67 years. He was born in Wales, in 1844, came to this country as a mining engineer and became associated with the Pratt Coal & Coke Co. He later went to the DeBardeleben Co., until the Tennessee Coal, Iron & Railroad Co. absorbed it.

Francis H. Stillman died at his home in Brooklyn, N. Y., Feb. 17, aged 62 years. He was born in New York and graduated from Yale University. He engaged in the manufacture of machinery and aided in building up the successful business of the Watson-Stillman Co., manufacturer of hydraulic machinery, of which he was president. He had been a director of the National Association of Manufacturers and president of the National Metal Trades Association.

Jerome A. Snedaker died at Denver, Colo., Feb. 10, aged 54 years. He had just returned from a business trip to Duluth. Mr. Snedaker went to Colorado in 1881 and settled at Aspen, where he remained for several years. Having made considerable money in the Aspen district, Mr. Snedaker went to Denver and began to practice as a mining engineer. He was associated with A. E. Reynolds for several years. During his life in Colorado, Mr. Snedaker became wealthy. He leaves a widow and one son, who is a student in the Colorado School of Mines.

Societies and Technical Schools

American Mining Congress—The Southwestern Land and Zinc Chapter of the Mining Congress has been organized at oplin, Mo., with 100 members. Col. H. H. Gregg is president.

International Congress for Industrial Hygiene and the Prevention of Accidents—The members of the American honorary committee of this congress, to be held at Milan, Italy, in May next, are: James McCrea, E. A. S. Clarke, George B. Cortelyou, Philip T. Dodge, S. C. Dunham, Elbert H. Gary, John Hays Hammond, A. Barton Hepburn, Seth Low, Charles Nagel and James Speyer. On the national committee, 38 representatives of various industries and other interests will serve.

International Congress of Applied Chemistry—The officers and committee in charge of arrangement for the eighth meeting, which will be held in New York and Washington in September next, have prepared a pamphlet for distribution among prospective authors of contributions to the congress. This contains rules and suggestions to be followed in writing the papers to be presented. Bernhard C. Hesse, 25 Broad St., New York, is secretary of the congress.

Colorado School of Mines—The sum of $12,500 was recently turned over to the authorities of the School of Mines for the equipment of the new ore testing plant. The building for the plant was built a year ago and $50,000 was allowed by the legislature for the necessary machinery; one-fourth of this is what is now available. Many donations of machinery have been made by various manufacturers and it will now be possible to equip, ready for operation, the concentration section of the plant. Prof. W. G. Haldane will be in direct charge of the work.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Feb. 14—The present active quartz mining in the three chief counties of the Mother Lode region includes the operation of 20 stamp mills dropping an aggregate of 900 stamps; the installation of new stamp mills, cyanide mills, hoisting machinery, and a large amount of repair and development work in the reopening of the old mines and prospecting new claims. There are a few mills idle temporarily, pending repairs or the installation of additional machinery. Notwithstanding the rather long period of dry weather there is no disposition to anticipate a shortage of water, but rather an inclination to depend upon the prospect of an average precipitation.

There is a spirit of progressive development and operation at Tuolumne, Sonora, Jacksonville, Jamestown, Angels, Campo Seco, Jackson, Sutter Creek, Amador City and Plymouth. A similar movement in new work obtains in Mariposa County, at the south end, and Eldorado County, at the north end of the Mother Lode. No recent season has been more active in any of the mining towns and districts either in the number of stamps dropping or in new installations. The noteworthy installations in progress are in Tuolumne and Amador Counties. The Black Oak, near the town of Tuolumne, is installing a new 75-ton all-slimes cyanide mill; the Dutch, near Jamestown, is adding 20 new stamps to the present 20-stamp mill; both of these plants will be in operation in April. The new hoist at the Plymouth Consolidated in the north of Amador County, is about completed, and the unwatering of the mine should be in progress soon. A new 20-stamp mill is being built at the Poundstone, near Sutter Creek; this mill is manufactured by the same local establishment at Altaville, that built the Plymouth hoist. The South Jackson Mining Co. is preparing for the erection of an electric hoist, with a capacity of 2000 ft., to be employed in the development of a new mine at Jackson. In Calaveras County the most recent new installation was the addition of 10 new stamps to the 30-stamp mill at the North Star mine, at Angels. Another recent installation at Angels that is of interest is the placing of a new Pacific concentrator in the Stickels mill by the Utica company; this is now being given a practical test of efficiency and economy. Various economies in appliances and in construction of treatment plants are being tried out and many improvements in methods have been adopted in the present season. There is, in fact, an evidence of progress in almost every department of mine operation on the Mother Lode, and the strongest indications of permanency of quartz-mining advancement.

Denver

Feb. 16—Resuscitation of the old mining camp of Creede, a few mines of which are credited with a production of $12,000,000, is assuming concrete form. These mines are the Creede United, Amethyst and the Last Chance, the owners of which have granted a 20-years' lease to a new corporation known as the Creede Triune Mines Co. of which John H. Berkshire, president of the National Bank of the Republic, Kansas City, Mo., is the head; John Evans, chief engineer of the Denver Tramway Co., is vice-president and Judge J. E. McFadden of Kansas City, Mo., secretary. The plan of development is to go below the present level, known as the Nelson tunnel level, on the Amethyst, and to follow the known oreshoots downward, with an initial expenditure of $200,000 in this exploitation work. W. F. De Camp, once superintendent of the Portland mine, Cripple Creek, is in charge of the work, and he will sink a 2-compartment shaft from Amethyst ground.

In *Bull.* 512, by Whitman Cross and A. R. Schultz, of the U. S. Geological Survey is a description of about 20 lava caps or mesas in the Leucite Hills in the Rock Springs coal-mining district of Wyoming, with estimates of the potash contents in the rock in sight, based on analyses which show an average of 10%, and total nearly 200,000,000 tons of potash. But the bulletin states: "Several reduction processes for extracting potash from igneous rock have been patented, but thus far none has proved commercially successful. The extraction of all the potash from these refractory silicates involves many difficulties, and not only has no process yet been perfected, but in the opinion of many industrial chemists no promising process has even been suggested that can be successfully applied on a commercial scale." The American Potash Co. of which Theodore F. Van Wagenen, mining engineer of Denver, is president and general manager, owns property in this district and claims to have developed a process that has worked satisfactorily in the laboratory. The company will proceed to erect a test plant on the ground and experiment on a working scale to ascertain whether the potash and alumina can be extracted and marketed at a profit such as the laboratory tests indicated.

Butte

Feb. 14—Although there has as yet been no radical reduction in the cost of producing copper as a result of the substitution of compressed air for steam as power by the Anaconda company, owing to the fact that only four or five mines are being operated in this manner, still from a cost of 11c. per lb., at which cost the metal was mined only a few years ago, a reduction to a point under 9.5c. per lb. has already been made, and this in the face of the fact that the mines have been steadily growing deeper, meaning greater expense. The reduction is the result of many economies in both mining and smelting operations.

The survey of the route of the new extension of the Butte, Anaconda & Pacific R.R., into the Georgetown district, has been completed, and it is expected that grading will be commenced by Mar. 1 and that the road will be completed by early autumn. Several bids for the contract work have been received, and they will all be in within a few days. The new extension will have a length of about 22 miles, consisting of 16 miles of main line beyond the present end of the line, and approximately six miles of sidetracks. The road will follow Warm Springs Creek to a point near the 8-mile house, where heavy country causes a detour of 1.5 miles to be made before returning to the valley which it will follow to Silver Lake and which body of water it will skirt on the north shore as the wagon road does. It will then follow the foothills, passing a short distance from the Gold Coin mine, and will terminate at the Southern Cross mine in the Georgetown district. The entire grade will be slightly under 2 per cent.

Salt Lake City

Feb. 15—The Knight Power Co. and the Utah County Light & Power Co. have consolidated under the name of the Knight Consolidated Power Co. The company has nine plants in this state: Two in Mill Creek Cañon; two in American Fork Cañon; one in the town of American Fork; one in Alpine Cañon; one in Santaquin; one on the Provo River, and one on Snake Creek. More plants will be

constructed throughout Utah, as occasion arises. The capitalization is $2,000,000. Jesse Knight is president and A. P. Merrill is general manager.

An unusual accident happened on Feb. 15 at Bingham, Utah, though our readers who are acquainted with the precipitous slopes of Bingham Cañon will appreciate the circumstances. Several men were killed and injured when a locomotive hauling an ore train left the Rio Grande track, rolled down a hill, and crashed through the roof of the Bingham State Bank.

The work done on the Utah Metal Mining Co.'s tunnel, which is being driven to connect the Bingham and Tooele sides of the Oquirrh Mountains, amounts to 7500 ft., and according to the annual report just issued, it is expected that the 4000 ft. remaining will be completed by August. Since December, when new drills were installed at both ends, the work has been progressing at the rate of 20 ft. per day, 10 ft. being made from each end. The cost per foot is exceptionally low. The work is approaching ground where mineral is expected. In the Bingham end there is a firm, hard porphyry with a little copper staining in the seams. On the Tooele side, it is expected that the Jordan and Commercial limestone beds, which outcrop 2000 to 2500 ft. above the point where the tunnel begins, will be cut less than 8000 ft. from the portal. All the work on the Tooele side has been done by hydro-electric power generated from water sources owned by the company. These streams, which have been greatly developed during the year, are a valuable asset.

Houghton, Mich.

Feb. 16—As the price for copper metal continues to hold above 14c. per lb., the general feeling in the Lake district assumes a more optimistic tone. Exploration work continues in the horizon of the Lake and Baltic lodes, both north and south of Portage Lake. Recent disclosures by drilling have brought the Mayflower property into particular prominence and together with underground developments at the St. Louis exploration and the New Baltic property have attracted attention to the possibilities of that horizon lying near the Eastern sandstone and north of Portage Lake. Until this work was started, this section had been neglected for many years. It bids fair now to be the scene of considerable future exploratory operations. Recent reports state that the Calumet & Hecla company have offered $15 per share for the minority stock of the St. Louis Copper Co., the company reserving the right to refuse or take all or any part of the stock to be offered on or before Apr. 15, if less than 2500 shares are offered. Of the 40,000 shares of this company, the Calumet & Hecla now owns 35,500 shares.

According to reports, the old Osceola property may again occupy a prominent position as a bone of contention between the present management, which is the Calumet & Hecla company, and the minority stockholders, represented by the old Osceola Protective Committee, which has been inactive for some time. One of the questions to be asked of the management includes the reason for continuing the shutdown of the property with copper metal selling for 14c. per lb. or more.

Negaunee, Mich.

Feb. 16—The two concrete shafts sunk by the Foundation Co. on Sec. 35 near Rice Lake, in the Gwinn district, have been completed to bedrock and sinking in rock is in progress. The overburden was about 90 ft. thick and compressed air was used, with the caisson method. The water level was but a few feet below surface; clam-shell dredging was possible for several months until compressed air became necessary from Nov. 1 to Dec. 30. The same air compressor was used for both shafts, the caisson work being finished at one shaft before starting the other. The shafts are circular in outside cross-section, and rectangular inside. The shafts have been named the Mackinaw and the Gardner. It is the policy of the Cleveland-Cliffs Iron Co., for whom the work was done, to sink two shafts at a property for improved ventilation and to afford a means of escape in case of accident.

Porcupine

Feb. 16—The South Porcupine board of trade is making preparations for a celebration to signalize the starting of the Dome mill, which is set for Mar. 23. It is expected that the Dome directors will be here, and many other well known mining men have been invited. Every effort will be made to make memorable the date for the starting of the era of production in Porcupine. Business in the district continues to be stagnant, and there does not seem to be any immediate indication of its becoming better. Few new companies are being formed, and there is practically no possibility of raising money from the public for the development of new properties. The only things that do not seem to suffer are the prices asked for claims. These remain as high as ever.

Chihuahua

Feb. 11—The revolutionary disturbances are working hardships on the mining industry throughout the state, but foreigners have not suffered either personal or property damage. The same regard is being shown for foreigners as during the revolution of last year. Owing to the suspension of service on the Mexico Northwestern Ry., a number of properties closed down, principally in the Cusihuiriachic camp, while operations have been greatly curtailed by large companies owing to inability of marketing their products and of getting in supplies. Service, however, is being resumed, with little fear of further interruption. Regular train service between here and El Paso has been maintained for over a week, and service south is anticipated within two weeks and perhaps sooner depending on the time and labor required for repairing the track and bridges.

The local smeltery has operated regularly at normal capacity, and as the plant has plenty of ore on hand and is receiving a regular supply from the Santa Eulalia camp, in addition to having an abundance of coke, there is no probability of a shutdown. The fuel supply has also been well arranged for and several trainloads of coke are to be shipped from El Paso soon. This secondary disturbance comes at a most inopportune time, considering the fact that with the recent visit of the New York and Mexico officials of the company, an appropriation of about $250,000 was made for betterments including two new furnaces, machinery and dwelling houses. The foundations and pits for these furnaces are already completed and the steel work is *en route* from the factories. It is not believed that any delay will be occasioned by the trouble, however.

The situation locally is not regarded as serious inasmuch as the Maderista authorities have things well in hand now. The wives and families of many Americans have left for the states, but the majority of the men are staying in expectation of an early adjustment of affairs. It is apparent that neither the workingmen nor the majority of the former Maderista soldiers are in any way sympathetic with the cause, whatever the latter may be. The workmen have shown this by the starting of a widespread movement for the organization of citizens' protective bodies, similar to the American vigilance committees, for the better protection of themselves from bodily and property harm and incidentally for the affording to foreigners of guarantees which the local government might or might not be able to give, if serious trouble should arise. The former Maderista soldiers, and particularly those who after the close of the former revolution returned to their ranches and ordinary vocations, have shown this by volunteering their services to the Maderista leader Gen. Pascual Orozco, who is showing himself to be the man of the hour as well as the same popular idol of the people. The miners particularly are on record as opposed to further trouble, stating that they want to work uninterruptedly, and not to renew their experiences of idleness and hunger of last year's revolutionary times. These are matters which taken collectively have tended to minimize the seriousness of the trouble among thinking foreigners.

The Mining News

The Current History of Mining

Alaska

Bonanza—This copper mine has paid to shareholders an initial disbursement of $1,000,000, the declaration having been 5made possible by the opening of the recently completed railroad. This dividend is the first disbursement of any consequence to be declared by an Alaskan copper mining company. The increasing price of the metal means renewed activity in the copper fields of that section, and several companies which have been idle are getting ready to ship copper now. In April, 1911, the Bonanza began to ship and it continues to be the heaviest shipper of copper in Alaska. During recent months it has shipped 16,000 tons of ore averaging about 70 per cent. copper, or about $3,500,000 worth of metal.

Arizona

Gila County

Southwestern Miami—At the annual meeting of the stockholders held in Globe, Feb. 12, it was voted to increase the capitalization from 50,000 shares to 100,000 shares, par value $5. The increase of 50,000 shares was taken by William A. Paine, of the firm of Paine, Webber & Co., of Boston, Mass., and associates, at $4 per share for $2, paid-in stock, which, with the money received from the recent call of $1 per share on 35,000 shares will give over $200,000 for payments on the property and for its development. There are now issued and outstanding 15,000 shares of full-paid stock, and 85,000 shares of $2-paid stock upon which $3 per share can still be called, giving an additional $255,000 should it become necessary. It is proposed to purchase two additional churn drills, making three in all, and to continue the exploration of the property. It is estimated that the money now on hand will be sufficient to meet the payments on the property, purchase the additional equipment and operate the three churn drills for nearly two years, or until Jan. 1, 1914.

Barney—The churn-drill hole that is being drilled in the bottom of the 400-ft. shaft on this group, has passed out of the schist into dacite and is now over 800 ft. below the collar of the shaft. E. B. Tinker is superintendent.

Live Oak—The enlargement of No. 2 shaft from two to three compartments has been started. Jack McIvor has the contract for the work and has hired some of the best miners of the district. The shaft is 928 ft. deep and will be enlarged by raising from four or five points. It is expected that the work will be finished in about 2½ months. In the meantime a double-drum hoist and two 150-hp. boilers will be erected, and development of the orebody from this shaft will be resumed as soon as the shaft work is finished. Development is now in progress from No. 1 shaft near the eastern end of the property. M. E. McCarthy is superintendent.

Inspiration—Work is progressing on the water-supply dam for the concentrator and tests are still being conducted by J. M. Callow in the experimental mill. A trestle is being built from the main tunnel to the site of the new warehouse.

Miami—The mine is producing at the rate of over 2500 tons per day from the 420-ft. level and development on the 570-ft. level continues. Five units of the concentrator are in operation. In place of the rigid rolls, a Hardinge ball mill is being tried out in one unit and a set of spring rolls in another.

Yavapai County

United Verde—At the annual meeting held recently, it was disclosed that the company's investments at the end of 1911 were valued at $1,666,394, unchanged from the previous year. During 1911, production amounted to 33,167,987 lb. copper, 461,145 oz. silver and 15,239 oz. gold. Gross proceeds were: Copper, $4,174,478; silver, $246,665; gold, $315,-691; total, $4,736,834. Regarding the new smeltery, Vice-President MacDonald stated that a portion of it had been ordered, and that the company will be able to finance the construction, possibly through borrowing money. No details regarding capacity of the new plant could be obtained.

California

Amador County

Bunker Hill—It will require further time to complete the repair of the working shaft which was caved on Feb. 7 by the falling of a skip, the latter causing the imprisonment of the day shift men for 24 hr. The report circulated that the timbers in the shaft were rotted, is untrue; they have been in place only about a year and a half. The 40-stamp mill was kept running on a surplus supply of ore. Work on the exit and drain tunnel is also in progress. E. Hampton is superintendent.

Keystone—The owners of this and the Wildman-Mahoney mines have brought suit against the California Consolidated Co. to quiet title. The representative of the defendant has vacated the Keystone under instruction of the sheriff. The property is being developed under the direction of C. R. Downs, superintendent.

Eureka—The recent visit to Sutter Creek and inspection of this mine by Col. Edward H. Green, of New York, is taken to mean that the property is to be reopened. It has been idle for the last 26 years but was formerly a producer. The South Eureka, about 800 ft. distant, is one of the large dividend payers of the district, with 80 stamps dropping, and the Central Eureka is also a pay producer, with a 40-stamp mill. There is no apparent reason for the continued idleness of the Eureka.

Butte County

Blue Hog—John Lopizich, of Los Angeles is reported to have inspected this mine recently. The property was purchased a short time ago by the Feather River Land & Mining Co., of which Mr. Lopozich is a director.

Morris Ravine—The largest nugget uncovered in Butte County for a number of years was taken from this mine on Jan. 27. It is 5 in. long, 3 in. wide, and weighs 27 oz. Richard Phillips is owner.

Kern County

Midway Gas Co.—Application has been made to the supervisors of Kern County for a franchise for a gas pipe line from the Buena Vista hills through the county. This is a part of the system for which a franchise has been sought in Los Angeles County. The application is made by A. C. Balch, secretary of the Pacific Light & Power Co. An offer is made to pay the county 2% of the gross receipts after the first five years of operation. Three pipe lines are contemplated.

Arondo—The working force is being increased at this mine at Randsburg and it is reported that more milling machinery will be added soon.

Cashier—This company at Harrisburg is said to be considering the erection of a new mill this summer.

MARIPOSA COUNTY

Crown Lead—The stamp mill is being overhauled and a large number of men are idle.

NEVADA COUNTY

Champion—Self-dumping ore skips have been installed at the Providence shaft. The skips dump into a large bin having three chutes. This installation provides rapid handling of ores from the lower levels.

Alaska—The new buildings have been completed at this mine at Pike and work under Robert Hathaway has started on the mill; 20 stamps will be added to the present 20 and the mill will be moved nearer the hoist.

SHASTA COUNTY

Victor Power & Mining—It is reported that this company has consolidated with the Grand Central Gold Mining Co., and that it also has an option of purchase on the Midas mine. The Victor has a 20-ton mill and the Grand Central owns 10 claims the main veins of which can be economically worked from the 500-ft. level in the Victor ground. The Midas is an old mine and a large producer. It was recently said to be nearing the end of its large production, but since then new orebodies are reported to have been opened. A combination of the closely related mines in Harrison Gulch would be a step toward economic and modern mining.

SIERRA COUNTY

Jensen—Rich free-milling quartz has been found in this property at Downieville, while extending the main tunnel.

Davis—At these placer diggings, four miles north of Downieville, coarse gold has been recently uncovered.

Telegraph—At this gravel mine, near Downieville, the veins of quartz recently cut are to be developed soon; machine drills are now being installed.

Four Hills—A cyanide expert has been employed for some time at this mine, near Downieville, with the result that a plant will be installed as soon as equipment can be brought in.

Emerald—At this group, in Jim Crow Cañon, the arrastra, recently installed, has begun grinding $20 ore, developed during the last year by the owners, Smith & Shippsy, of Downieville.

Dodson—Gravel carrying coarse gold continues to be found by James F. Hunt in the tunnel being driven here. A power hoist and pump are to be installed to drain the mine.

SISKIYOU COUNTY

McKinley—This mill in the Humbug district will soon start crushing ores mined in the several claims on this and other properties. J. P. C. Nash is owner.

Colorado

CRIPPLE CREEK DISTRICT

Aileen—Lessee Grigsby, at this property, on Guyot Hill, is reported to have opened 3 ft. of smelting ore at a depth of 600 ft., from which he has shipped 10 cars in six weeks.

Prince Albert—This company, on Beacon Hill, has decided to lease its entire property to some responsible individual or corporation.

Tornado—P. Witenberg, lessee at this property, on Raven Hill, is said to be getting rich ore on the Walker vein and is producing a car per week, one of which, recently sent out, is expected to bring $1200.

American Eagles—This mine is stated to have produced 500 tons of high-grade ore in January, the richest shipment from the 1100 level being settled for at $257 per ton.

Six Points—Lessees Polly & Chilson recently sent out a shipment which they estimate will run 15 oz. gold per ton.

Gold King—A strike of 18 in. of sylvanite ore, assay samples of which give 26 oz. gold per ton, is reported by Victor Porter, lessee at this mine, in Poverty Gulch.

Ajax—The first cleanup at the Clancy process mill, at the Ajax mine, is being made, and Judge Colburn, president, has promised official figures as to the saving and the costs.

GUNNISON COUNTY

The Gold Links mines, the Raymond property and the Carter, all adjoining one another on the now celebrated gold belt on Ohio Creek, about five miles above Ohio City, are working full forces, and as each has its own mill at the mouth of their long crosscut tunnels, they are turning out large amounts of bullion, concentrates and smelting ore. The general character of the ore is galena carrying gold, the general average of the value, outside of the smelting ore, being about $15 per ton, and the width about 4 ft. The smelting streak carries from 2 to 8 oz. gold and 7 to 10% lead. They are all supposed to be on the same vein or on two closely parallel veins in the granite and gneiss formation.

LAKE COUNTY—LEADVILLE

Lessees on the Bullion shaft, Stray Horse Gulch, the Bennett lease on the Farmers, the Silent Friend in South Evans Gulch, and No. 5 shaft on the La Plata, California Gulch, are all shipping ore.

Dinero—The vein has been driven on for 700 ft. in the tunnel from the point where intersected and shipments of good grade are going out steadily.

St. Louis—Work has been resumed on the St. Louis tunnel in Big Evans Gulch, and a new electric hoist is to be installed in the tunnel where a shaft will be sunk 450 feet.

Mt. Champion—In the tunnel of this company in Lackawanna Gulch, 6 ft. of gold-silver-lead ore have been opened.

SUMMIT COUNTY

In the Breckenridge district, the operators of the dredges in the stream placers expect a heavy output of gold for the year, as all three of the dredges will be working in virgin ground of known richness. The Reliance dredge, which is equipped with steam heat, has been working all winter and dredging 30 ft. below the surface. The Reiling boat of the French Gulch Dredging Co. is being overhauled and refitted for the season's work, and so is Bucyrus No. 2 boat of the Colorado Gold Dredging Company.

Wellington Mines—This company, the largest producer in the district, has sunk its shaft to 825 ft., and is now drifting on 5 ft. of lead-zinc-iron ore. A new magnetic separator is being installed to handle the zinc middlings from the 100-ton concentration mill on the property.

Golden Beaver—A strike of rich auriferous copper pyrite ore is reported from this property, in the upper Blue River district; the vein is 2½ ft. wide. J. G. Detwiler is president of the company.

Idaho

Deer Creek Mining & Milling Co.—This company is contemplating the installation of machinery on its properties in the Deer Creek section of the Salmon River region, as soon as the roads are favorable for moving machinery.

Michigan

COPPER

During the last few weeks a large amount of copper has been shipped by rail from the various smelteries. The shipments have been so consistent and of such size that the amount of available copper in storage at the various docks has been greatly reduced; upon the opening of navigation the amount of copper on hand will be less than it has been for a number of years.

Hancock—The shaft is down about 3320 ft. in a trap formation streaked with copper, which is believed to be the capping of the Pewabic lode. When this lode is reached, attention will be given to the opening of the ground preparatory to mining on a large scale. The shaft and equipment is of the best in the district, and is capable of handling a large tonnage. The company owns its stamp-mill site, but nothing further has been done along this line.

Oneco—The shaft on the property is down about 1100 ft. Stations have been established at intervals of 100 ft. all the way down, and in cutting the plat at

the ninth level, some rich ground was exposed in the hanging wall of the lode. Developments at this property are being watched with interest, as are those at other properties lying in this horizon, particularly the St. Louis, Mayflower and New Baltic.

Isle Royale—Conditions at this property are in good shape, production is being gradually increased to the limit of the present stamping facilities, and, at the present price of copper metal, the company is more than meeting expenses. In all probability steps will be taken within a short time to increase the milling facilities, and it is rumored that the company will issue 5% bonds to meet these requirements.

Osceola—At a recent meeting in Detroit, attended by W. J. Uren, Charles Turner, W. C. Kauth and others it is reported that 15 questions were drafted and presented to the Calumet & Hecla management with the request that they be answered prior to the annual meeting of stockholders in March. These questions pertain principally to Osceola affairs and it is said that the so called Hyams interests will make a determined fight for control of this property.

St. Marys Mineral Land Co.—The report for the year ended Dec. 31, 1911, shows receipts of $798,896 made up as follows: Previous balance, $368,576; Champion Copper dividend, $250,000; notes collected, $156,400; pay for wood and timber, $12,046; ground rent, $2286; miscellaneous, $9587. Expenditures were: King Philip assessment, $83,905; Winona, $56,774; Hancock, $40,000; Ojibway, $2000; Franklin, $3142; Old Colony, $80; Houghton Copper, advanced, $17,500; dividends, $480,000; miscellaneous, $34,231; cash on hand, Dec. 31, $81,263. On Dec. 31, the real property of the company consisted of 93,246 acres besides mineral rights to 14,038 additional acres.

Iron

Jones & Laughlin—Diamond drilling is being carried on at the Mitchell mine, near Winthrop, the contract for which has been let to the Duluth Diamond Drill Company.

Oliver Iron Mining Co.—Following a visit of Pres. W. J. Olcott, the company's mines at Ishpeming will resume 6 days' work per week on day shift in place of the 4-day week which has been in force for nine months. About 400 men are affected; no night-shift mining has been done yet.

Cleveland-Cliffs Iron Co.—The protest against taxes paid for 1911 on mines in the Ishpeming-Negaunee district has expired, as no suit was filed in the 30 days following the protest.

Rolling Mill—The second shaft at this mine, in the Negaunee Basin, has been raised to surface from the 620-ft. level; the opening is 8x8 ft. and will be enlarged to 12x14 ft. Raising has been in progress for five months, with three miners on each 8-hr. shift, who trammed the rock 650 ft. to No. 1 shaft. The new shaft is west of shaft No. 1, which is 730 ft. deep. Hoisting machinery will be installed at shaft No. 2, and mine ventilation will be improved. About 140 men are employed at the mine. Capt. E. N. Corey is in charge of the underground work.

Hollister—A large pump has been installed in this mine of the M. A. Hanna company at Crystal Falls. The underground workings are extremely wet and the ore is dried in a mechanical dryer before being shipped.

Minnesota

A new mine may be opened this season on a 40-acre tract near the Adriatic mine at Aurora. It is reported that a shaft will be sunk, at a site near the Adriatic No. 2 stockpile.

Minnesota Steel Co.—This subsidiary of the U. S. Steel Corporation, at West Duluth has ordered 1554 tons of structural steel for iron-ore and limestone bins in its new plant.

Missouri

S. V. & D.—This mine near Carthage has been reopened and made a "turnin" recently.

Golden Glow—This mine at Webb City has installed a 700-ft. rope-haulage system.

Hill Top—A company has taken over this old mine at Oronogo and will drain the ground and erect a large mill. F. E. Weeks, of Joplin, is manager.

Great Western—This mine at Thoms Station will soon have its mill completed.

Short Creek Mining Co.—The company has taken a lease on the Connor land at Central City, has drained the ground and will move the Blue Grass mill to the land.

Continental—This company is preparing to install a gasoline locomotive for underground haulage at its mine in Prosperity.

Park—W. C. Thomas has made several good drill strikes on this land at Thoms Station.

Edmond Lyon—Three hundred tons of zinc concentrates have been sold by this company at Webb City, and 1500 tons are still in the bin.

Weaver—This company operating north of Carl Junction has sold 400 tons of ore.

West & Becker—This company has just completed the erection of a mill at its mine at Thoms Station.

Martin Peters—The erection of a mill is being commenced by this company on its lease at Thoms Station.

Montana

Butte District

Tuolumne—The new hoist was started recently and production will be increased.

Butte & Superior—Directors of the company have been in Butte on a trip of inspection of the property. Among those present were Capt. A. B. Wolvin, president; William White, J. F. Killorin, and John G. Williams, all of Duluth, and N. B. McKilvie, a New York director, in company with A. K. Furland, and Leo Furland of Paris, France. The visitors inspected the mine and the construction of the new mill, and made the trip to Basin to see the operations of the mill there. While in Butte they were the guests of the officials of the Anaconda company and were shown through the mines and the Washoe plant at Anaconda.

Broadwater County

The mining camp of Radersburg is steadily progressing and at present there are nearly 400 men on the payrolls there, with many properties being operated and new ones being opened. Although not definitely known, it now seems certain that construction will soon commence on a branch of the Chicago, Milwaukee & Puget Sound R.R. from Three Forks into the camp, as the intended route has been surveyed and mining operations there would seem to justify the building of the road. On the strength of this probability the camp is experiencing a small boom.

Carbon County

Ruby—This company was recently organized with a capital of 1,000,000 shares, $1 par, to operate a group of six claims 3.5 miles from Cooke City. In the past some development work has been done and gold, copper and rubies were discovered in the deposits. On one of the claims a tunnel has been driven 125 ft., and a crosscut driven to a good body of ore. Also a shaft was sunk 25 ft. on the vein and fair gold ore was found. A shaft has been sunk 32 ft. on another claim and a tunnel driven 50 ft., at which point sulphide ore was found in the face. The Mountain Rose claim is traversed by six veins, all of which, after a small amount of prospecting, were found to contain ore of varying grade. It is planned to develop the property thoroughly.

Lincoln County

Kalispell-Lincoln—The company has announced that a 5-stamp mill will be installed at the property in the West Fisher district this spring. Recent tests are reported to have been satisfactory.

Park County

Yellowstone Portland Cement Co.—This company, a $6,000,000 corporation, will soon begin installing the machinery in the first unit of the cement mill on the Yellowstone River near Gardiner, and

it is expected that by June 1 the plant will be in readiness to manufacture the only white cement turned out in America, from the immense deposits of wonderfully pure limestone in that region. At a meeting of the company's directors, Feb. 7, officers were elected as follows: T. J. Walsh, of Helena, president; Frank Henry, of Livingston, vice-president; C. S. Hefferlin, of Livingston, treasurer; and A. H. France, secretary.

SILVER BOW COUNTY

Laurium-Montana—Work is progressing steadily at this property a few miles south of Butte. The main tunnel is in nearly 300 ft. and the vein matter has been improving recently. The quartz is highly mineralized and carries considerable pink manganese containing a good silver content and some gold. John E. Parthan, of Ely, Minn., a heavy stockholder and manager of the company, has just inspected the property.

Nevada

COMSTOCK LODE

Ophir—The west crosscut from the south drift on the 2100-ft. level has cut a seam of quartz in a strong formation and this is being developed. The assays from this latest prospect are low to date. The quartz closely adjoins old stopes that yielded thousands of dollars in the early days. The recovery last week, from the 2100- and 2200-ft. levels was $12,065.

Mexican—The mill resumed operations last week after a shutdown for a cleanup and for the installation of a new classifier; 398 tons of ore were treated. The average value of the heads was $17.95 per ton and the gross value of the ore treated was $7144. The capacity and grade of the heads are now being gradually increased, and an effort made to bring the plant up to specifications. Sampling the stopes in the mine, preparatory to ore extraction, has now been completed.

Cosmopolitan — Three shifts of men have been placed at work in the mine, and regular ore shipments are being maintained to the Fischer mill.

Comstock-Quartz—Arrangements have been completed for the reopening of this property. New and uptodate hoisting and mining equipment will be installed as soon as possible.

Crown Point—Ore shipments last week included 884 tons to the Yellow Jacket mill. The latter plant has been operating steadily on Crown Point ore since Jan. 25. A railroad car of concentrates was shipped to the smeltery last week.

Belcher—North drift No. 2 on the 1400-ft. level is being extended along the course of a promising vein, from which several cars of low-grade ore have already been saved. It is believed that the mine will soon become a regular producer.

Combination—Preliminary work has been started with the idea in view of again placing this shaft in commission. Lumber has been ordered to brattice two compartments down to the present water level. The shaft was one of the largest on the Comstock in the early days and was sunk to the 3100-ft. level, where it cut the main Comstock vein. The shaft is of four compartments and is in good condition.

NYE COUNTY

Jim Butler—President Heller has stated that operations through the Wandering Boy shaft will be resumed soon. This shaft is 600 ft. deep and will be carried deeper. A powerful electric hoist will be substituted for the present gasoline one. The ore will be treated at the Tonopah-Belmont company's mill.

McNamara—The new guides and timbers are in place in the shaft to the 800-ft. level in preparation for development at and above this point. Some trouble was experienced in filling the filter presses recently and it was necessary to close the mill for a short time. This trouble has been overcome and a good tonnage is being treated.

West End—Development work continues. On the 400-ft. level a crosscut north has been started from a point about 200 ft. east of the shaft. The winze from the 300-ft. level has reached a depth of 57 ft. and a connecting drift has been started.

Halifax-Tonopah—The triple-compartment main working shaft has reached a depth of 830 ft. and is sinking in hard andesite formation.

North Star—Good shipping ore is being opened on the upper levels. The ore bins at the railroad switch are now being filled with ore.

Tonopah Mining—The report of the company for January shows that 14,943 tons of ore were milled, of an average value of $18.60 per ton. The gross receipts were $309,165 and net profits were $143,340.

Tonopah-Belmont—The report for January states that 7698 tons of ore were milled and 2665 tons were shipped to smelteries, the net profits for the month amounting to $151,487.

Montgomery-Shoshone— The annual meeting called for Feb. 14 was adjourned without date for lack of a quorum. Two plans were to have been presented; one called for the filing of a petition in involuntary bankruptcy. The company's indebtedness, other than current bills, totals $236,403 and interest from Jan. 1, 1912. The second plan provided for the sale of the machinery and other movable property of the subsidiary companies in Nevada and the payment of the proceeds to the consolidated company.

New Mexico

GRANT COUNTY

Lucky Boy—A car of 14 tons of ore recently shipped from this mine is reported to have averaged 7.47% vanadium.

American Vanadium Co.—It is rumored that this company will work the Georgetown mine for vanadium.

Chino—The single unit in operation up to Jan. 1, treated about 700 tons per day. With the second unit in commission, the daily tonnage is being increased to about 1000 tons per unit. It is estimated that the recovery from the sulphide ores has been over 70%. The third section of the mill is about ready.

SOCORRO COUNTY

Deadwood—Some excellent ore has been uncovered on the third level. The mill is running steadily, treating mostly custom ore.

Ernestine—The cleanup for the last 10 days of January yielded 9450 oz. of gold and silver bullion and 9250 lb. of concentrates. The mill is treating nearly 700 tons of ore per week. The oreshoot encountered some time ago is producing the best mill ore in the mine.

Pacific—A gasoline hoist is being installed at the south shaft of this mine of the Oaks company and will be ready for operation soon. Some good ore is being broken in the tunnel and the south shaft is producing a small tonnage. All the ore is treated at the Deadwood mill.

Socorro — One unit of the De La Vergne oil-engine equipment is being tried out.

Oregon

Blue Ledge—Title to this copper mine in Jackson County has been conveyed by U. S. patent to Robert S. Towne. It is reported that development on a larger scale will be undertaken soon.

Cornucopia—The company is said to be planning improvements at the Union mine in Baker County, to double the present capacity. Fine-grinding will be used.

Oriole—At a recent meeting at Grants Pass it was decided to install a new 50-ton mill. The shaft will also be sunk deeper.

Utah

BEAVER COUNTY

Majestic—A small force is working at the Harrington-Hickory mine, pending the arrival and installation of the new pumping equipment.

Progressive—Good ore is being mined at this property in the Star district. A 30-ton car netting $900 was shipped in December.

JUAB COUNTY

Tintic shipments for the week ended Feb. 9 amounted to 192 cars. The Centennial-Eureka shipped five cars more

than the week preceding, the Mammoth six, the Iron Blossom five and the Yankee two.

Colorado—The ore recently opened on the 300-ft. level of No. 2 shaft, appears to be making toward the east into new ground, a short distance below the large stopes. During the week ended Feb. 9 two cars running about 30% lead and from 45 to 50 oz. silver per ton were mined from this orebody.

Beck Tunnel—Drifting from the shaft is being done on the 900-, 600- and 175-ft. levels, and work in ore is being done in the old workings and along the Uncle Sam side line. It is said that present shipments of two cars per week, are to be increased.

Grand Central—The shaft is being sunk 3½ ft. per day. Shipments are being maintained.

Opohongo—The weekly output, principally from the third, sixth and seventh levels, is 200 tons. The orebody has been mined as far as the 700 level, where it is being drifted on. This work has progressed for 60 ft. in low-grade ore. On the 1000-ft. level, where prospecting is being done, the fissure has been followed 50 feet.

Eagle & Blue Bell—Ore has been opened a short distance above the 1300. During January, 24 cars were shipped from the 1300 level, the ore running approximately 1.6 oz. gold and 20 oz. silver.

Iron Blossom—Ore is reported to have been opened in both of two raises from the 600-ft. level of the No. 3 workings. These are, respectively, 100 ft. to the north and 100 ft. to the south of ore at present being mined. The copper ore opened from the 600-ft. level is being followed by means of a raise also. Two shifts are working. Production for the week ended Feb. 9 was 44 cars. There has been a steady increase in production for the last six weeks. March had the largest output of any month in 1911, when from 44 to 46 cars per week were produced, with three shifts working. The average monthly production for the year was a little more than 32 cars. The gross monthly earnings at the present rate of production with ore bringing from $12 to $15 per ton, after payment of freight and smeltery charges, are estimated at $120,000.

Mammoth—Increased shipments are being made from the orebody opened several months ago on the 700- and 800-ft. levels in a new part of the property. The ore is being followed on the 700-ft. level where the showing is particularly good, and on the 600 drifting is being done for the vein. During the week ended Feb. 9, the mine shipped 12 cars.

Victoria—A new body of ore is reported on the 1200-ft. level. Work continues on the raise from the 1200 to the 1050, and the latter is being connected with the 900 by means of raising. This work will facilitate mining and give better ventilation.

Yankee—Work is being done on the 1800- and 1900-ft. levels. Shipments of dump ore are being made at the rate of two cars per day.

Salt Lake County

Utah Consolidated—There is a porphyry dike on this property 10 to 45 ft. wide, cutting the Highland Boy limestone from the fifth level. This dike has been driven through on the 1100-ft. level, and ore has been drifted on for 25 ft. on the hanging-wall side of the limestone. Where first opened the body was 6 ft. thick, carrying 2.2% copper. With depth the area of limestone above the dike increases. On the 1100, the lowest level, there is still a width of 60 ft. of limestone below the dike. So far the copper ore of the mine has come from below the dike, the limestone above it having been little developed on the upper levels, on account of the smallness of its area there. About 2000 ft. of underground development are being done monthly; ore shipments are being increased, and reserves added to.

Ohio Copper—The net earnings for December are estimated to be about $30,000, and the cost of production less than 9c. per pound.

Columbus Consolidated—The mine has been unwatered. On the tunnel level drifting is being done in search of the Enterprise fissure. In drifting to the east on the 400, a body of shipping ore from 8 in. to 3 ft. wide has been opened for 20 ft. A car of this ore has been shipped, and it is expected to bring about $55 per ton. Ore averaging 5 ft. in width has been found in a raise from the same level. Improvements have been made at the mill which has closed down, pending the blocking out of more milling ore.

Cardiff—Owing to bad roads, work on ore has stopped, and development is being done. The most important work is in the lower drain and development tunnel, 300 ft. below the main tunnel. This is in 250 ft., and is progressing 3 ft. per day. During last summer the monthly average shipped was 125 tons, valued at about $6000.

Utah Mines Coalition—The annual stockholders' meeting was held Feb. 5, and the directorate was reëlected. Duncan MacVichie is president. A winze, which is being sunk from the 900-ft. level, is down 65 to 75 feet.

Tar Baby—The tunnel is in 300 ft., and there is copper and iron staining in the face.

Kennebec—Work has been resumed by Heath & Werthlin, leasers on this property.

Copper Bank Mining—This property, northwest of the Verde, consists of six claims in Big Cottonwood Cañon, lying between the power plants. At the stockholders' meeting recently held, a new board of directors was elected. C. E. Street is president.

Summit County

Barry-Coxe—The new lower tunnel, which is being driven on the vein, is in 85 ft. and the ore mined is reported to be paying expenses, though it is somewhat bunchy.

Beggs-Miller—This company's concentrating plant below Park City will soon resume operations. The mill has 24 MacQuisten tubes and three Wilfley tables. It was designed to treat the zinc tailings of the Grasselli company. The plant has recently been closed to make some changes and adjustments.

Washington

U-Like—This property at Corlew, Ferry County, is being operated by C. H. Lewis and J. H. Clay with satisfactory results. A crew will work through the winter.

Hope—This company is considering the erection of a 125-ton mill on the property, Ferry County. Robert Mabry, Spokane, has charge of the work.

Wisconsin

Peaceful Valley—The 100-ton mill equipment, near Cuba City, was totally destroyed by fire on Feb. 12. It is reported that the plant will be rebuilt immediately. H. L. Hulburt Cuba City, is general manager.

Lucky Six—The "Dodger" mine, situated between the Squirrel and Peacock properties at Mifflin, has been sold to Milwaukee men. The mine has made a good showing with a 20-ton mill completed a few months ago. James Vial is superintendent.

East End—The shaft on this property, at Platteville, has been completed, and stockholders believe they have found the vein of the Klar Piquette mine, immediately adjoining. A mill will be constructed. M. H. Bruner is general manager.

Washburn—Drilling on this property, 10 miles north of Platteville, has revealed rich ground ahead of the old workings. The mine will be reopened after a 2-years' shutdown.

National Zinc Separating Co.—Foundations have been completed for the roasting and magnetic separating plant, near Cuba City; the plant will treat zinc ore from the mines owned and operated by the Vinegar Hill Zinc Company.

Crahall—The milling plant on this property, at New Diggings, has been completed by the Field Mining Company.

Canada

British Columbia

According to press dispatches, the British Columbia government proposes to send engineers to the country between Stewart and Ground Hog Mountain to obtain data as to the conditions for the construction of a railroad from Stewart to tap the Ground Hog Mountain coal fields. This line eventually is to form a link in another transcontinental system.

Nova Scotia

Canada Consolidated Clay Co.—This company has been organized, at Pictou, with an authorized capital of $2,000,000, with the object of amalgamating the clay companies of the Maritime Provinces. Some of the financiers connected with it have secured control of the more important brick- and china-clay deposits.

Ontario—Cobalt

Cobalt shipments for the week ended Feb. 16 were: La Rose, 229,804 lb.; McKinley-Darragh, 224,019; Drummond, 180,000; Nipissing, 120,076; O'Brien, 64,097; Kerr Lake, 64,000; Hudson Bay, 61,905; Buffalo, 60,939; Beaver, 59,801; Townsite, 59,000; total, 1,131,641 lb. Bullion shipments were: Nipissing, 127,329 oz.; Temiskaming, 31,646; Buffalo, 8600; Kerr Lake, 2321; City of Cobalt, 1618; total, 171,436 ounces.

Colonial—This company, which went into bankruptcy in December, has been reorganized and will issue bonds for $200,000 to raise funds for development.

Coniagas—An important discovery has been made in stoping out No. 9 vein. Hitherto when the Keewatin formation was reached on the properties west of Cobalt Lake, the veins pinched out at the contact. In this case, however, the vein was followed into the Keewatin and has been opened for 25 ft., showing 3 to 4 in. of ore running over 2000 oz. per ton. If the vein persists at depth, a winze will be sunk and another level run in what was previously supposed to be barren territory.

Little Nipissing—The lease held by this company from the Peterson Lake company has been cancelled under a clause providing for its termination in case of no work being done for one month. The property is now being operated by the Peterson Lake company.

Buffalo-Ontario Smelting & Refining Co.—This company has purchased property on Cataraqui Bay, Kingston, for the erection of a smeltery for the treatment of Cobalt and other ores.

Temiskaming—The annual report shows a production during 1911 of 1,213,754 oz., of the gross value of $643,322, and profits amounting to $271,423, of which $224,999 were paid in dividends. The total amount paid in dividends to date is $1,009,155.

Ontario—Porcupine

Mulholland—The management has decided to sink the main shaft to 300 feet.

Dome Extension—Good ore has been discovered in the crosscut from the 200-ft. level of the main shaft.

North Dome—This property is suffering from a shortage of water and may have to shut down for a time, until an adequate supply can be obtained.

Dome Lake—A compressor plant will be installed on this property. The vein, which is 3 to 4 ft. wide on surface, has been stripped and traced for over 900 ft. Two shafts are down 60 ft. in good ore, but the results of diamond-drill work have not been encouraging, as at a depth of 100 ft. the pay streak averages only about 1 ft. and the grade is erratic.

Crown Chartered—It is understood that the company's finances are now in satisfactory condition, and that work is to be resumed on the Davidson property.

McIntyre—Feb. 23 is the date officially set for the first trial run of the 10-stamp mill, and it is hoped to begin regular working by Mar. 1. A drift is being run from shaft No. 1, which will be the main working shaft, to No. 4 shaft on the south side of Pearl Lake, through which drift the ore will be carried in tram cars.

Imperial—The management has decided to close down the property temporarily, until proper machinery can be installed and adequate funds for development obtained.

Porcupine Gold—The blind vein, cut at the 200-ft. level, in opening up the station, has been drifted upon for 30 ft. At the point where it was cut it shows about 5 ft. of ore.

Mexico

American Smelting & Refining Co.—All five plants of the company in the republic are in operation, and no difficulty has been experienced because of the political situation. Government troops have afforded the company protection where needed.

Chihuahua

El Rayo—The new 14-in. rolls arrived in Parral recently and have been shipped to the mine. It is reported that the company will build an aërial tramway for carrying firewood to the mine.

Veta Colorado—Shipments of concentrates and bullion are being made regularly from the mill at Villa Escobedo. The concentrates are sent to the smeltery at Torreon.

Alvarado—The water at the Presena mine is reported to be at the eighth level and it is expected that the large station pump on that level will be started soon. The Dorr thickeners at the mill have been started. Work is expected to start soon at Las Cruces mine. This property has an inclined shaft, 450 ft. deep, equipped with a 25-hp. hoist and two boilers.

Tepehuan Mexican Syndicate—Machinery, including a new hoist and a Cameron sinker pump, was shipped from Parral recently. One hoist is in operation at present; the intention is to pursue development vigorously.

Dolores—An accident due to foul air recently resulted in the death of two miners at this mine. The accident took place in a 300-ft. drift and is said to have been caused by the failure of the day shift to turn on the air at the end of the shift.

La Republica—Scarcity of labor has retarded progress at the mine and mill, since work was resumed in December. In September, the mine closed down because of an excessive flow of water; this was finally controlled and work was resumed. During January 34 bars of buiion worth about $37,000 were shipped and in December it is said more than $12,000 worth of concentrates were shipped to the smeltery. The mill is treating about 40 tons per day, which will be increased if labor conditions improve. J. Gordon Hardy is consulting engineer.

Mexico

El Oro—During January the mill crushed 25,410 tons of ore which yielded $186,550 gross. Working expenses were $101,880; development, $18,700; permanent improvement, $9950; mine profit $65,970; railway profit $12,480; and $78,450 total profit.

Sonora

Cieniguita—It is reported that the reorganization of the various Cieniguita companies is about completed on a satisfactory basis; that the Mexican company will be clear and free of all indebtedness of every kind and character, and that the debts and obligations of the various holding companies will be taken care of; further, that the stockholders of the various holding companies will be fully protected in their various interests. Inquiry at headquarters among those effecting the reorganization, develops the fact that John B. Farish, whose name has been mentioned in connection with the Cieniguita companies, is in no way interested in the corporations or the reorganization of them.

Asia

Chosen

Oriental—During December, 26,141 tons of ore were crushed, yielding $137,294 gross and net $51,779. Operating costs were $79,429; operating profit, $57,864; improvements and developments, $6085. The Kuk San Dong 40-stamp mill was hung up the entire month because of labor shortage.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Feb. 21—The special features of the trade this week seem to be the increasing disposition of large consumers to accumulate stocks, and some relaxation of the pressing demand due to the weather. The call for stocks is coming to be insistent, but railroad transportation is still slow and there is difficulty in getting coal to market. These conditions prevail both in the East and the West.

Nothing further has been done in relation to calling another meeting of the rate conference. It is probable that nothing will be done until after the anthracite miners' demands are presented, as they probably will be next week. The anthracite-mining companies have issued a statement to show the fairness of the existing agreement and the effect upon prices of any increase in wages.

Eastern operators are taking much interest in the probable general strike of miners in Great Britain, which is now reported to be almost certain.

German Coal Trade—Exports and imports of fuel in the German Empire, year ended Dec. 31, metric tons:

	Exports	Imports	Excess
Coal	27,412,218	10,913,948	Exp. 16,498,270
Brown coal	58,071	7,069,064	Imp. 7,010,993
Coke	4,555,477	598,958	Exp. 3,956,519
Briquets	2,477,492	200,933	Exp. 2,276,559
Total	34,503,258	18,782,903	Exp. 15,720,355
Total, 1910	30,436,048	19,458,046	Exp. 10,978,002

The increase in total exports was 4,067,210 tons; the decrease in imports, 675,143 tons.

Coal production of German Empire, year ended Dec. 31, metric tons:

	1910	1911	Changes
Coal	152,881,509	160,742,272	I. 7,860,763
Brown coal	69,104,867	73,516,789	I. 4,411,922
Total mined	221,986,376	234,259,061	I.12,272,685
Coke made	23,600,362	25,405,108	I. 1,804,746
Briquets made	19,567,016	21,827,667	I. 2,260,651

Of the briquets reported in 1911 a total of 16,836,679 tons was made of brown coal or lignite.

Iron Trade Review

New York, Feb. 21—The iron and steel trades are in practically unchanged condition. If anything, there is an increase in new orders, coming chiefly from structural demands, and from railroad-bridge and car orders. There is still competition for orders and prices remain low. Rail orders are rather slow, and will probably remain so until the fencing over specifications and quality is over.

Conditions at the mills are better, as the extremely cold weather seems to be over. Railroad transportation is still slow, however, notwithstanding the improvement in the weather. Complaints are made of shortage of cars and defective motive power in many quarters.

New business in pig iron is fair, but prices do not advance. The general belief in lower ore prices is one element in the resistance to any increase in pig. No one knows what Lake ore prices will be, but few doubt that there will be a reduction from last season. Any reduction in ore, however, may be offset by advances in coke.

A conference was held last week in New York, at which representatives of a number of railroads and leading steel manufacturers were present. The subject of discussion was the quality of steel rails and the possibility of adopting standard specifications and methods of manufacture, in order to secure better rails. No results are reported, but it is understood that marked differences of opinion were developed.

Baltimore

Feb. 19—Exports for the week included 882 lb. selenium to Hamburg; 4,225,700 lb. steel rails and 388,889 lb. track material to Tampico, Mexico. Imports included 1100 tons ferromanganese and 74 casks silicospiegel from Liverpool; 9720 bars Swedish charcoal iron and 32 casks manganese ore from Hamburg; 23,700 tons iron ore from Cuba.

Birmingham

Feb. 19—Southern pig-iron manufacturers have a strong line of inquiries in hand and no special complaint is made as to conditions. Pig-iron prices hold at $10.50 per ton, No. 2 foundry, and while the sales have not been so numerous of late as they were in January, there is a satisfactory condition. The make in Southern territory is not likely to be increased for a while yet and the accumulated stocks of iron appear to be quite sufficient to help out in case of a rush in the demand. There is more iron being shipped out and melted in the home territory than is being manufactured here, but manufacturers say that this can continue for a few months without depleting all stocks. The sales already made for delivery during the first half of the year are good, while a little business has been booked for the latter half of the year. No effort has been made to secure any volume of business for the last half of the year.

The steel situation in this section is looking up and reports have it that Southern railroads have announced prospective business which is practically assured the local companies. There is a steady demand for fabricated steel and steel-wire goods.

Charcoal iron is in fairly good demand, $22@22.50 being the quotation. The scrap-iron market shows a little improvement, as does the business with the foundries and machine shops in the Southern territory. The cast-iron pipe people are still melting a large quantity of iron.

Chicago

Feb. 19—Sales of pig iron continue light, the melters adhering to their practice of buying in small quantities and often, which they have followed for several months. Inquiries are more numerous and one is for several thousand tons, but most of these inquiries are regarded as attempts to feel the market. The furnace representatives are trying hard to hold prices to the quotations of $14 for Northern and $10.50, Birmingham, for Southern No. 2, the local price on the latter being $14.85. Business is better in Northern than in Southern foundry iron, though few sales run over 500 tons each.

The market for iron and steel products is better than the pig-iron market. Structural material continues to sell well, with a number of bridge and building contracts closed in the last week in local and Western territory and increasing requirements appearing for spring building. Beams and channels under 15 in. are quoted at 1.28@1.33c. Railroad supplies other than rails are in good demand; the rail business continues light. Bar iron is active, with 1.25c. minimum on the products of local mills and hardly any cutting under by the Pittsburg producers. Sheets and plates are not so active, but there is a fair trade in both, and wire goods are selling heavily. Considered as a whole, the market for finished products seems to be decidedly improving, while pig iron shows no signs of weakening and some features that indicate a stronger tone.

Cleveland

Feb. 19—Some sales of ore have been made, but no prices have been fixed. Sellers and buyers of ore have been very slow in getting together. Shipments of

ore from Lake Erie docks in January were 284,569 tons. This light business was mainly due to the extremely cold weather.

Pig Iron—Several sales of basic are reported, and a fair tonnage in small orders for No. 2 foundry. Prices, Cleveland delivery, are $15.15 for bessemer, $13.10@13.25 for basic, $13.25 for No. 2 foundry and $16.50 for Lake Superior charcoal.

Corrigan, McKinney & Co. have arranged to build a third stack for their blast-furnace plant on the west side of the Cuyahoga River. The new stack will have a capacity of about 75,000 tons yearly, and will be run on basic pig for the openhearth-steel plant which the company is preparing to erect.

Finished Material—The wire trade is the most active branch of the business just now. The sheet market is rather quiet, and not much is doing in bars. There is more competition for plate orders, and prices are being shaded.

Philadelphia

Feb. 21—Another period of inactivity has set in, which is not being disturbed by important inquiries. Large consumers in and near this city do not believe the slight advance made recently can be maintained. In accordance with this belief no efforts are being made to negotiate for further forward deliveries. Nearly all large consumers are comfortably supplied for some time and the only activity anticipated depends on the casual purchases of the small trade. In the aggregate this business is quite large. Furnace interests generally express satisfaction with the present situation and the absence of probable competition from Southern furnaces. Two or three quite large lots of low-grade iron have been sold for delivery scattering over three or four months. Basic pig is weak. Forge iron is selling from week to week in the customary way. Foundry irons are strong. This week's sales of malleable figure up a little above the average. No. 2 X averages $15; gray forge and basic $14.50. Some southern forge has been offered as low as $13.50 and two or three sales are likely to result.

Billets—The latest transactions in billets show that recently quoted prices are maintained but the orders are very light.

Bars—Open weather has permitted more prompt shipment of delayed supplies. There is better distribution from stores. A good jobbing demand for making up depleted assortments will soon set in.

Sheets—Black and galvanized are selling better in small lots from stores for immediate delivery.

Pipes and Tubes—Cast pipe orders are large and steady. Merchant pipe has improved. Tube work is abundant.

Plates—The week has been comparatively quiet. The only encouragement is in inquiries for boiler plate. Shipyard work is taking much material.

Structural Material—Considerable bridge, ship and car work is now under consideration, most of it for April and May delivery. Bottom prices remain.

Scrap—Dealers report very little business. The only sales are for immediate delivery. Prices are at barely remunerative limits.

Pittsburg

Feb. 20—On the whole, the finished-steel market has neither gained nor lost ground in the past week. There appears to be no greater weakness in prices than there was, and in plates some of the mills have found the market stronger in the past few days than they expected. While bars, plates and shapes are quotable at 1.10c., Pittsburg, and have been so quotable for several weeks, there is at least one important mill which will not sell at less than 1.15c., while there are several mills which would shade this figure only in exceptional cases, as, for instance, to retain a particular customer. In bars and shapes the market is quite firm at a minimum of 1.10c., this price not obtaining in the case of all business.

There is no difficulty in the mills having all the specifications they need to maintain full operations. They had an excellent accumulation at the first of the year, and while in some cases new specifications since then have been below production, the deficit is not large. In unfinished steel there is an actual scarcity.

The important new feature in the situation is the scarcity of box cars, suitable for loading commodities like black plates and tin plates. There has been a scarcity for several weeks, due to cold weather, and this has reached an acute stage within the past few days, so that material has accumulated in warehouse and in some cases the continuance of full operations in certain departments has been threatened. The slow movement has had an interesting result, in that some buyers have been moved to increase their specifications in order to provide against future emergencies of this sort. The freight movement continues slow, although the present mild weather is expected to loosen up the situation. The Pennsylvania, New York Central and other roads a few days ago placed an embargo on freight intended for Michigan and adjacent territory, the whole State of Michigan being tied up by the worst freight congestion known in years.

Pig Iron—The pig-iron market continues uneventful. The consumers of foundry iron for the most part covered for the present quarter before the close of the old year, and are taking deliveries at a satisfactory rate. Little fresh demand is coming up. The operating furnaces are well sold and are making little effort to sell iron. Basic iron is generally quoted at $12.50, Valley, but the last important sale, some time ago, was on the basis of $12.25, Valley. It is reported that the Pittsburg Steel Co. bought about 12,000 tons for March delivery at about this figure. We continue to quote: Bessemer, $14@14.25; basic, $12.25@12.50; No. 2 foundry, $13@13.25; malleable, $13@13.25; forge, $12.50@12.75, all f.o.b. Valley furnaces and 90c. higher, delivered Pittsburg.

Ferromanganese—The market continues quiet, with the price well maintained at $41, Baltimore, for prompt or forward.

Steel—Some of the large producers are behind in deliveries of both billets and sheet bars, and there is considerable inquiry for small prompt lots. F.o.b. Pittsburg, bessemer billets command $19.50@20 and bessemer sheet bars $20.50@21, but openhearth sheet bars are a trifle easier, not being in as much demand as bessemer, and are quotable at $20@20.50, Pittsburg. Bessemer billets at Youngstown are quotable at $19@19.50 and bessemer sheet bars at $20@20.50. Rods are nominally $25, Pittsburg.

Sheets—The sheet market holds up fairly well, the majority of producers being comfortably sold up. The leading interest's specifications are excellent, and it is not a factor in the market at prices less than the basis of 1.90c. for black and 2.90c. for galvanized. These figures, however, are shaded rather freely by several independent interests. We continue to quote: Black sheets, 28 gage, 1.85@1.90c.; galvanized, 2.85@2.90c.; blue annealed, 10 gage, 1.35@1.40c.; painted corrugated, $1.33@1.35 per square; galvanized corrugated, $2.47@2.50 per square.

St. Louis

Feb. 19—The market continues to be a waiting one and no large orders are expected till next month. There is a fair business in small orders. Quotations for No. 2 Southern are still $10@10.25, Birmingham, or $13.75@14, St. Louis; No. 2 Northern, $14@14.75, St. Louis.

Demand for coke continues good, with prices at $5.05@5.20, St. Louis.

Iron Ore Trade

The Great Northern R.R. Co. has announced that its freight rate on iron ore from the mines to Lake Superior docks for the season will be 60c. per ton, the same as is now charged by the other Minnesota roads. This is a reduction of 20c. per ton from last season.

E. N. Breitung & Co., of Cleveland, report some good sales of ore, most of them on prices to be determined later. Other sellers and buyers are slow.

Foreign Iron Trade

German Foreign Trade—Exports and imports of iron and steel and of machinery in the German Empire, year ended Dec. 31, metric tons:

	Exports	Imports	Excess
Iron and steel..	5,377,287	600,563	Exp. 4,776,724
Machinery.....	474,130	76,129	Exp. 398,001
Total.....	5,851,417	676,692	Exp. 5,174,725
Total, 1910.....	5,269,214	629,675	Exp. 4,639,539

Increase in exports, 582,203 tons; increase in imports, 47,017 tons.

Belgian Iron Trade—Exports and imports of iron and steel in Belgium, year ended Dec. 31, metric tons:

	Exports	Imports	Excess
Pig iron.....	11,610	693,235	Imp. 681,625
Billets, etc.....	143,568	69,003	Exp. 74,565
Finished mat..	1,354,536	289,408	Exp. 1,065,128
Total.....	1,509,714	1,051,646	Exp. 458,068
Total, 1910....	1,422,887	1,046,144	Exp. 376,743

The increase in exports was 86,827 tons, or 6 per cent.; that in imports was 5502 tons, or 0.5 per cent.

British Iron and Steel Trade

Exports and imports of iron and steel, and of machinery, in Great Britain, month of January, are valued by the Board of Trade returns as below:

	Exports	Imports	Excess
Iron and steel	£4,387,160	£1,085,083	Ex. £3,302,077
Machinery...	2,014,218	356,351	Ex. 1,657,867
Cutlery and hardware..	569,162	118,592	Ex. 450,570
New ships....	183,222	.....	Ex. 183,222
Total..... ..	£7,153,762	£1,560,026	Ex. £5,593,736
Total, 1911..	6,453,643	1,348,652	Ex. 5,104,991

Increase in exports, £700,119; increase in imports, £211,374. The quantities of iron and steel exports were, in long tons:

	1911	1912	Changes
Exports.....	396,467	449,903	I. 53,439
Imports.....	134,147	180,536	I. 44,386

Tinplate exports to the United States decreased from 5921 tons in 1911 to 234 tons this year.

METAL MARKETS

New York, Feb. 21—The markets have shown few changes during the week. A fair business is reported in most lines.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Jan. 1912..	$ 1,915,202	$ 5,165,543	Imp. $3,250,341
" 1911..	923,676	9,540,830	Imp. 8,617,154
Year 1912..	1 915,202	5,165,543	Imp. 3,250,341
" 1911..	923,676	9,540,830	Imp. 8,617,154
Silver:			
Jan. 1912..	6,027,905	4,358,009	Exp. 1,669,896
" 1911..	5,651,076	3,551,426	Exp. 2,099,650
Year 1912..	6,027,905	4,358,009	Exp. 1,669,896
" 1911..	5,651,076	3,551,426	Exp. 2,099,650

Exports from the port of New York, week ended Feb. 17: Gold, $34,976; silver, $1,531,208, chiefly to London and Paris. Imports: Gold, $456,510, principally from Mexico; silver, $62,385, largely from South America.

Gold—Prices on the open market in London continued at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was no special demand. In New York a total of $2,900,000 gold was taken for shipment to Argentina.

Iridium—Prices are unchanged, $64 per oz. being asked for pure metal.

Platinum—The market is quiet, and we continue to quote $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Feb. 7, that the market is steady. Prices are 10 rubles per zolotnik for crude metal, 83 per cent. platinum, at Ekaterinburg; 38,600 rubles per pood for the same grade at St. Petersburg. These prices are equivalent to $37.60 and $37.83 per oz., respectively.

Notwithstanding the stimulus of high prices, production increased little last year. The output in Russia for 1911 is 334 poods of crude platinum, an increase of 22 poods, or 6.6 per cent., over 1910. The total for 1911 was equal to 175,818 oz. crude, or approximately 145,929 oz. refined platinum.

Silver—The market has been carried up for silver by combined speculative and legitimate operations to 27⅞d. At this figure heavy sales on China account broke the price to 26¾d. Reaction took the price up again to 27 5/16d., but orders have not been sufficient to sustain this figure so the situation today is quiet at 27 1/16d. in London.

SILVER AND STERLING EXCHANGE

Feb.	15	16	17	19	20	21
New York....	59⅝	58⅛	58½	59¾	59¾	58⅞
London.....	27 7/16	26¾	27	27 5/16	27 5/16	27 1/16
Sterling Ex..	4.8705	4.8720	4.8730	4.8730	4.8735	4.8740

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Feb. 8, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£1,332,300	£953,300	D. £379,000
China.....	176,000	350,000	I. 174,000
Total.....	£1,508,300	£1,303,300	D. £205,000

India Council bills in London averaged 16.13d. per rupee for the week.

Gold in the United States, Feb. 1, is estimated by the Treasury Department as follows: Held against gold certificates, $1,035,612,369; in Treasury current balances, $164,195,516; in banks and circulation, $603,474,436; total, $1,803,282,321, an increase of $6,281,405 during January.

Gold and silver movement in Great Britain, year ended Dec. 31:

	Imports	Exports	Excess
Gold.....£	48,693,753	£40,100,540	Imp.£ 8,593,213
Gold, 1910..	57,321,767	50,898,445	Imp. 6,423,322
Silver.....	14,293,747	16.923.537	Exp. 2,629,790
Silver, 1910.	14,100,310	13,826,768	Imp. 273,542

Of the silver imported in 1911 a total of £11,897,923 was from the United States.

Copper, Tin, Lead and Zinc

NEW YORK

Feb.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
15	14¼ @14⅜	14.10 @14.15	42¾	4.00	3.92½	6.45 @6.60	6.30 @6.45
16	14¼ @14⅜	14.10 @14.15	43	4.00	3.92½	6.45 @6.60	6.30 @6.45
17	14¼ @14⅜	14.10 @14.15	43	4.00	3.92½	6.45 @6.60	6.30 @6.45
19	14⅜ @14⅝	14.20 @14.25	43	4.00	3.92½	6.45 @6.60	6.30 @6.45
20	14⅜ @14⅝	14.20 @14.25	42⅞	4.00	3.92½	6.45 @6.60	6.30 @6.45
21	14⅜ @14⅝	14.20 @14.25	43⅛	4.00	3.92½	6.45 @6.60	6.30 @6.45

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Feb.	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
15	62⅞	63 1/16	67	194⅛	191⅛	15¾	26¾
16	63⅛	63 1/16	67¼	195⅛	191¾	15¾	26¾
17	.....	.....	.....	.....	.....	.....	.....
19	63	63¾	67⅛	194⅛	191⅛	15¾	26¾
20	63	63 1/16	67¼	194¼	191¼	15¾	26¾
21	63¾	64	67¼	195¼	192	15¾	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The persistent policy of certain of the leading sellers in holding their prices firm at 14½c., delivered at consumers' points, 30 days, appears at last to be telling on the market. From all accounts, consumption is well maintained throughout the world. There have of late been some inquiries from the Far East, which would indicate that the Japanese production, which to a large extent was exported to Europe and to this country, does not now suffice to satisfy the requirements of China and Japan. In the early part of the week sales of electrolytic were still made at 14¼c., delivered, usual terms, but with the continued abstention from the market of some of the

large interests the relatively moderate demand was sufficient to advance the price, which became 14⅜c., delivered, usual terms, at which price copper was still offered at the close. Some moderate sales of Lake copper for domestic consumption at 14⅜@14½c. have been reported. The business in electrolytic has been fairly divided between domestic and foreign shipment. The market closes firm at 14⅜@14½c. for Lake copper, while electrolytic copper in cakes, ingots and wirebars is quoted at 14.20@14¼c. Casting copper is quoted nominally at 13⅞ to 14⅛ as the average for the week.

The London standard market, while fluctuating within narrow limits, has displayed a firm undertone, and closes slightly higher at £63 7s. 6d. for spot and £64 for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for smaller quantities. Copper wire is now 15¼c. base, carload lots at mill.

Copper exports from New York for the week were 10,065 long tons. Our special correspondent gives the exports from Baltimore at 1730 tons.

Visible stocks of copper in Europe on Feb. 15 are reported as follows: Great Britain, 39,310; France, 5380; Rotterdam, 4600; Hamburg, 8100; afloat from Chile, 2450; afloat from Australia, 6000; total, 65,840 long tons, or 147,481,600 lb. This is a decrease of 2840 tons, or 6,361,600 lb. from the Jan. 31 report.

Tin—Shipments from the East for the first half of this month are extraordinarily large, and when this fact became known it had a depressing influence on the London market. The latter has become extremely dull and transactions have dwindled down to a minimum. It is reported that the Syndicate members refuse to deal on the new Metal Exchange contract, and that the bulk of the dealings in Straits-Malacca tin are consummated outside of the Exchange at about £1 over the posted Exchange quotations. Owing to the large shipments to this market and the recent arrivals, spot tin is very easy and selling slightly below the importation point. The market closes firm at £195 5s. for spot and £192 for three months, and here about 43⅛ for February tin.

London Metal Exchange quotations are now for "Standard" tin, under the new rules, and not for Straits or Australian as heretofore. The quantity of tin available for trading is increased by the new contract, but the quantity of tin available to consumers of the metal is not affected by the change.

Messrs. Robertson & Bense report the receipts of tin ore and concentrates at Hamburg, Germany, in January at 1226 tons; 1216 tons from Bolivia and 10 tons from South Africa.

Tin production of the Federated Malay States in January was 3829 long tons in 1911, and 3715 in 1912; decrease, 114 tons.

Lead—The market is unchanged at 4c., New York, and 3.92½c., St. Louis, at which prices the leading sellers are understood to have booked a large business, outside producers having in the main stood out of the market in the meanwhile.

The foreign market has been steady throughout the week at £15 15s. for Spanish lead and 5s. more for English.

Spelter—Near-by deliveries are still held at a heavy premium, but business this side of April has been of very small volume. Fair-sized orders were placed for April and May, and smelters are inclined to raise their prices for the future months. The market closes firm at 6.30@6.45c., St. Louis, and 6.45@6.60c., New York.

The London market is unchanged at £26 15s. for good ordinaries and 2s. 6d. more for specials.

Zinc dust is quoted at 7⅜c. per lb., New York.

Base price of zinc sheets was advanced ¼c. on Feb. 13 and is now $8.25 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business is steady, and prices show little or no change. Quotations are 19¼@19¾c. per lb. for No. 1 ingots, New York delivery.

Antimony—Business remains rather of a retail order, but Cookson's has been advanced a little, to 7¼@7⅜c. per lb. Hallett's is unchanged at 7⅜@7½c., which 6¾@6⅞c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is steady at unchanged prices. The New York quotation is $46 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $45 for domestic orders and $42.50 for export. The London price is £8 7s. 6d. per flask, while £8 5s. is quoted from second hands.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 17—The highest price paid for zinc sulphide ore was $49 per ton, the base, per ton of 60 per cent. zinc, $43@46.50. Zinc silicate ore sold on a base of $25@27 per ton of 40 per cent. zinc. The average price is $42.20. The high price of lead ore was $52, and the average price, all grades of lead, was $50.24 per ton.

While this week's shipment of zinc ore is over 6000 tons, yet it represents but a little over one-half the tonnage sold, as the district was scoured from one end to the other where there was a carload of ore in the bins, and a number of purchases were made of next week's output. The highest estimate of unsold ore made tonight was a little rise of 600 tons, while a number of estimates are under 500 tons. A majority of the smelting companies were in on the division of stock. With the enormous purchases the demand for cars far exceeded the supply, which has been short for several weeks, and resort was made to loading in open coal cars.

SHIPMENTS, WEEK ENDED FEB. 17

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,616,390	.....	1,092,670	$128,877
Joplin	2,188,250	.....	203,040	54,510
Carl Junction	928,560	.....	.....	22,285
Galena	680,110	.....	89,530	16,940
Alba-Neck	689,020	.....	.....	15,847
Miami	382,430	.....	202,700	12,155
Oronogo	506,530	.....	92,470	11,210
Granby	147,040	485,590	31,090	9,740
Duenweg	247,700	.....	86,690	7,491
Cave Springs	322,100	.....	24,000	6,730
Spurgeon	132,430	220,000	10,570	5,860
Carthage	217,790	.....	.....	4,573
Springfield	48,720	.....	32,800	1,620
Jackson	56,110	.....	.....	1,200
Quapaw	54,690	.....	.....	985
Aurora	.....	65,000	.....	910
Wentworth	30,170	.....	.....	633
Totals	11,248,050	770,590	1,865,610	$301,566
7 weeks	63,852,860	4,034,420	10,253,730	$1,750,644

Blende val., the week, $244,284; 7 weeks, $1,406,941
Calamine, the week, 10,400; 7 weeks, 54,804
Lead value, the week, 46,882; 7 weeks, 288,899

MONTHLY AVERAGE PRICES

Month	Zinc Ore: Base Price		Zinc Ore: All Ores		Lead Ore: All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	.....	39.16	.....	54.46	.....
March	39.85	.....	38.45	.....	54.57	.....
April	38.88	.....	37.47	.....	56.37	.....
May	38.25	.....	36.79	.....	55.21	.....
June	40.50	.....	38.18	.....	56.49	.....
July	40.75	.....	38.36	.....	58.81	.....
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Feb. 17—The base price paid this week for 60 per cent. zinc ore was $46. The base price offered for 80 per cent. lead ore was $48; no sales of lead ore were reported.

SHIPMENTS, WEEK ENDED FEB. 17

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	702,570	.....	.....
Benton	660,000	.....	193,700
Galena	645,800	.....	.....
Platteville	581,730	.....	.....
Hazel Green	479,800	.....	.....
Harker	361,800	.....	.....
Cuba City	275,050	.....	.....
Shullsburg	130,000	.....	.....
Montfort	79,360	80,000	.....
Rewey	62,000	.....	.....
Total	3,978,110	80,000	193,700
Year to date	24,134,700	666,080	1,698,300

Shipped during week to separating plants, 1,439,400 lb. zinc ore.

Chemicals

New York, Feb. 21—The general market shows no special animation, but is in fair condition. There is much interest in the new chemical schedule now before Congress.

Copper Sulphate—The market is unchanged. Prices are firm at last figures, $4.90 per 100 lb. for carload lots, and $5.15 per 100 lb. for smaller orders.

Nitrate of Soda—The market is still rather quiet, but there has been a slight firming up of prices. Quotations are 2.22½c. per lb. for spot and for futures up to June 30; and 2.20c. for later positions.

Sulphur—Messrs. Parsons & Petit, New York, furnish the following figures of the operations of the Consorzio Obbligatorio in Sicily for the five months of its fiscal year, from Aug. 1 to Dec. 31; the figures are in long tons:

	1910	1911	Changes
Production	180,171	161,727	D. 18,944
Shipments	133,297	143,940	I. 10,643
Stocks, Dec. 31	641,249	551,422	D. 89,827

The decrease in the production is owing to the shutting down of small mines, and the closing of the large Trabonella mine, owing to an explosion. It seems that this large mine will remain closed for many years, the damage having been much greater than was anticipated.

Arsenic—Demand is good and prices are unchanged, $2.62½@2.87½ per 100 lb. being asked for white arsenic.

Petroleum

The monthly report of the *Oil City Derrick* gives new wells completed in January as follows: New York, Pennsylvania and West Virginia, 271; Lima-Indiana, 23; Kentucky, 13; Illinois, 81; Kansas and Oklahoma, 208; Texas and Louisiana, 42. In all the divisions there were 638 wells completed, 315 fewer than in December. The new production was 31,488 bbl., a decrease from the December report of 4727 bbl. Of the completed wells, 108 were failures and 61 gas wells. On the last day of January there were 392 rigs up, an increase of 37, and 886 wells drilling, a decrease of 97, making a total decline of 60 in new work.

Mining Stocks

New York, Feb. 27—On Feb. 15 trading on the Exchange was rather active, but price changes were small, except for an advance of 1¼ in Amalgamated Copper. Trading on the Curb was active in spots only. Mason Valley and Braden were active among the coppers. There were some good sales of Porcupines, but Cobalts were slow. Prices closed about even.

Feb. 16 business on the Exchange was not heavy and there was a sharp drop in some of the leading issues. On the Curb trading was rather narrow. There was some interest in Butte Coalition again among the coppers. Wettlauffer Silver and Yukon Gold made considerable sales, at receding prices.

Feb. 17 business on the Exchange was light, but prices were inclined to be firm. Curb trading was irregular, with mining stocks in small demand and no considerable change in prices.

Feb. 19, while prices on the Exchange were generally firm, business was quiet. Sales of stock reported were the smallest since July 7 last. The Curb was dull and irregular, mining stocks receiving very little attention.

Feb. 20 and 21 the market continued dull and narrow. Steel common was heavy and coppers were slow on the Curb, while little was done in other mining stocks. One sale of Homestake was reported at $87.75 per share.

Sales at auction in New York, Feb. 15, included 61,170 shares Peregrina Mining & Milling common, $10 par, at 10c. per share; 1717 shares Pinguico Mines common, $10 par, at 10c. per share; 10 shares Mexican Milling & Transportation preferred, $100 par, at $10 per share, and 12,695 shares common, $10 par, at 10c. per share; five shares Guanajuato Reduction & Mining, $100 par, $10 per share; seven shares Guanajuato Development preferred, $100 par, $20 per share, and 7245 shares common, $100 par, at 50c. per share; 50 shares Tombstone Consolidated, $10 par, 5c. per share; 80 shares Imperial Copper, $10 each, 5c. per share; $16,000 Rex Carbon Coal Co. bonds, December, 1909, coupons attached, $2150 for the lot.

Boston, Feb. 20—Spasmodic movements in Mayflower and Old Colony shares have been the features in a dull but generally firm market. There have been fair-sized advances in other copper stocks and the market for these shares looks healthy, even though there is a lack of public interest in the entire market.

Advices from the Mayflower property continue favorable and a good-sized movement is afoot to wrest control of this property from its present management and effect a consolidation with the Old Colony. This can be thwarted by the St. Mary's Mineral Land Co., which owns 25,000 of the 100,000 shares.

Mayflower made a record price at $10.75, advancing $3.75 during the week. Old Colony during the same period rose $2.50 to $7.50. Osceola has risen $6.75 to $114.50, which is followed by talk that interests unfriendly to Calumet & Hecla are again making an attempt to make a contest for control this spring.

North Butte, Isle Royale, Mason Valley, Hancock and Winona have also been strong and active at times.

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	Nov.	Dec.	Jan.
Alaska shipments.	1,274,655	4,995,008	3,701,010
Anaconda	20,850,000	.....	26,350,000
Arizona, Ltd.	2,960,000	3,100,000	3,200,000
Balaklala	.....	.....	.....
Copper Queen	6,946,775	8,365,265	6,748,264
Calumet & Ariz.	4,390,000	4,486,000	4,544,000
Detroit	1,941,498	1,969,313	1,941,970
East Butte	983,405	.....	.....
Mammoth	1,793,181	1,721,404	.....
Mason Valley	.....	.....	600,000
Miami	2,500,000	2,500,000	2,600,000
Nevada Con.	5,207,983	4,679,674	.....
Old Dominion	2,082,000	2,610,000	2,044,000
Ray	2,517,000	2,660,000	.....
Shannon	1,256,000	.....	1,550,000
South Utah	361,681	267,514	189,678
United Verde*	2,500,000	2,000,000	.....
Utah Copper Co.	9,117,961	9,039,557	.....
Lake Superior*	18,600,000	17,500,000	.....
Non-rep. mines*	8,983,000	.....	.....
Total production.	94,265,139	.....	.....
Imports, bars, etc.	17,224,725	21,101,256	.....
Total blister	111,489,864	.....	.....
Imp. in ore & matte	4,767,217	5,159,997	.....
Total	116,257,081	.....	.....
Brit. Col. Cos.:			
British Col. Copper	.....	.....	.....
Granby	.....	.....	.....
Mexican Cos.:			
Boleo	.....	2,645,640	2,315,040
Cananea	.....	3,706,000	3,552,000
Moctezuma	1,682,768	2,864,464	2,732,867
Other Foreign:			
Cape Cop., S. Africa	857,920	.....	.....
Kyshtim, Russia	1,170,000	1,570,000	.....
Spassky, Russia	685,440	721,280	.....
Famatina, Argen.	174,720	217,280	.....
Exports from:			
Chile	4,704,000	5,824,000	8,064,000
Australia	7,168,000	11,200,000	7,056,000
Arrivals in Europe from other count.†	12,064,640	16,331,840	13,144,320

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
I, 1911	115,696,591	42,078,557	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904

	Visible Stocks		
	United States	Europe	Total
II, 1911	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Curb stocks have been heavy and the market has been somewhat uncertain. Eagle & Blue Bell rose to $1.06¼. Other features on the Curb have been the strength of Lion Hill and the weakness of Davis Daly.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	.....	$1.00
Alpha Con., Nev	Feb. 21	Mar. 13	0.05
Alta, Nev	Jan. 26	Feb. 16	0.05
Andes, Nev	Feb. 7	Feb. 28	0.05
Black Jack, Utah	Feb. 6	.....	0.01
Boston Ely, Nev	Jan. 18	.....	0.50
Confidence, Nev	Jan. 16	Feb. 6	0.20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev	Feb. 14	Mar. 6	0.05
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0.05
Hancock, Mich	Mar. 28	.....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
King David, Utah	Feb. 13	Mar. 6	0.005
Lehi Tintic, Utah	Feb. 29	.....	0.01½
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
Ojibway, Mich	Jan. 10	.....	1.005
Raven, Mont	Feb. 1	.....	0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz	Jan. 15	.....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002
Swansea Con., Utah	Jan. 17	Feb. 8	0.01
Tintic Standard, Utah	Jan. 8	Feb. 5	0.00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	.....	23.794	24.081	.....
March	51.454	52.745	.....	23.690	24.324	.....
April	53.221	53.325	.....	24.483	24.595	.....
May	53.870	53.308	.....	24.797	24.583	.....
June	53.462	53.043	.....	24.651	24.486	.....
July	54.150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24.428	24.082	.....
September	53.295	52.440	.....	24.567	24.209	.....
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	.....	12.611	.....	54.974	.....
March	12.139	.....	12.447	.....	54.704	.....
April	12.019	.....	12.275	.....	54.034	.....
May	11.989	.....	12.214	.....	54.313	.....
June	12.385	.....	12.611	.....	56.365	.....
July	12.463	.....	12.720	.....	56.673	.....
August	12.405	.....	12.634	.....	56.266	.....
September	12.201	.....	12.508	.....	55.253	.....
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	.....
February	41.614	.....	August	43.319	.....
March	40.157	.....	September	39.755	.....
April	42.185	.....	October	41.185	.....
May	43.115	.....	November	43.125	.....
June	44.606	.....	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	.....	4.266	.....	13.043	.....
March	4.394	.....	4.238	.....	13.122	.....
April	4.412	.....	4.262	.....	12.889	.....
May	4.373	.....	4.223	.....	12.984	.....
June	4.435	.....	4.292	.....	13.260	.....
July	4.499	.....	4.397	.....	13.530	.....
August	4.500	.....	4.406	.....	14.260	.....
September	4.485	.....	4.356	.....	14.744	.....
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	.....	5.368	.....	23.276	.....
March	5.563	.....	5.413	.....	23.016	.....
April	5.399	.....	5.249	.....	23.743	.....
May	5.348	.....	5.198	.....	24.375	.....
June	5.520	.....	5.370	.....	24.612	.....
July	5.695	.....	5.545	.....	25.006	.....
August	5.953	.....	5.803	.....	26.801	.....
September	5.869	.....	5.719	.....	27.750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	.....	14.50	.....	14.81	.....
March	15.90	.....	14.65	.....	14.96	.....
April	15.90	.....	14.65	.....	15.00	.....
May	15.90	.....	14.30	.....	14.72	.....
June	15.90	.....	14.06	.....	14.56	.....
July	15.90	.....	14.03	.....	14.53	.....
August	15.90	.....	14.00	.....	14.47	.....
September	15.90	.....	13.57	.....	14.40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14.25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS Feb. 20

Name of Comp.	Bid.
Acacia	.05⅝
Cripple Cr'k Con.	.02½
C. K. & N.	.15
Doctor Jack Pot	.05⅜
Elkton Con	.59
El Paso	.67½
Findlay	.05
Gold Dollar	.15½
Gold Sovereign	.02½
Isabella	.12½
Jack Pot	.05
Jennie Sample	.06
Lexington	.01
Moon Anchor	.01
Old Gold	.03⅛
Mary McKinney	.50
Pharmacist	.02
Portland	.91
Vindicator	.70
Work	.03

SALT LAKE Feb. 20

Name of Comp.	Bid.
Beck Tunnel	.14
Black Jack	.14½
Carisa	.15
Cedar Talisman	.02
Colorado Mining	.36
Columbus Con	.26
Daly-Judge	5.50
Grand Central	.79
Iron Blossom	1.22½
Little Bell	.43
Lower Mammoth	.03½
Mason Valley	12.50
May Day	.13
Nevada Hills	2.25
New York	.03⅜
Prince Con	1.02½
Silver King Coal'n	1.52½
Sioux Con	.11
Uncle Sam	.32
Yankee	.15

TORONTO Feb. 20

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.80	Pearl Lake	.19
Hudson Bay	‡70.00	Porcu. Gold	.43
Temiskaming	.35	Porcu. Tisdale	.03
Wettlaufer-Lor	.78	Preston E. D.	.05
Apex	.05	West Dome	.37½
Central	3.62½	Standard	.18
Dobie	.50	Foley O'Brien	.30
Dome Exten	.41	Rea	1.00
Hollinger	10.75	Crown Chartered	.13
Imperial	.05	Swastika	.23

SAN FRANCISCO Feb. 20

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.09	Belmont	9.60
Belcher	.65	Jim Butler	.37
Best & Belcher	.16	MacNamara	.21
Caledonia	4.25	Midway	.25
Challenge Con	.20	Mont.-Tonopah	1.12½
Chollar	.15	North Star	.30
Confidence	.80	West End Con	.87
Con. Virginia	.82	Atlanta	.15
Crown Point	.60	Booth	.05
Gould & Curry	.07	C.O.D. Con	.12
Hale & Norcross	.32	Comb. Frac	.14
Mexican	3.50	Jumbo Extension	.24
Occidental	.60	Pitts.-Silver Peak	1.22½
Ophir	1.45	Silver Pick	.06
Overman	1.55	St. Ives	.30
Potosi	.10	Tramp Con	‡.01
Savage	.27	Argonaut	‡2.50
Sierra Nevada	.35	Bunker Hill	5.50
Union Con	1.17½	Cent. Eureka	.33
Yellow Jacket	.52	So. Eureka	‡5.50

N. Y. EXCH. Feb. 20

Name of Comp.	Clg.
Amalgamated	65¼
Am. Agri. Chem	58¾
Am.Sm.&Ref.,com	71⅜
Am. Sm.& Ref., pf.	103⅞
Am. Sm. Sec., pf. B	86½
Anaconda	35⅜
Batopilas Min	1⅛
BethlehemSteelpf	58⅞
Chino	25⅝
Federal M.& S., pf.	40
Goldfield Con	4⅜
Great Nor., ore ctf.	37½
Homestake	87½
Miami Copper	23⅝
Nat'nalLead,com.	53⅛
National Lead, pf.	107
Nev. Consol	19
Pittsburg Coal, pf.	78
Ray Con	16¼
RepublicI&S,com	19⅞
Republic I & S, pf.	73
SlossSheffi'd,com.	37
Sloss Sheffield, pf.	‡108¼
Tennessee Copper	36¾
Utah Copper	56⅝
U. S. Steel, com	60⅜
U. S. Steel, pf.	108¾
Va. Car. Chem	54⅜

N. Y. CURB Feb. 20

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	.48
Braden Copper	5¼
B. C. Copper	4
Buffalo Mines	1.20
Butte & Vipond	.53
Butte Coalition	22⅜
Cobalt Central	‡.01
Con. Ariz Sm	⅛
Davis-Daly	⅝
Diam'field-Daisy	9
Ely Con	½
Florence	.65
Giroux	4⅜
Gold Hill Con	‡
Greene Cananea	7¾
Greenwater	.07
Guggen. Exp	180
Inspiration Con	18¾
Internat. S. & R.	128
Kerr Lake	3
La Rose	3⅞
McKinley-Dar-Sa.	17⅝
Min. Co. of A. new	3⅞
Nev. Utah M. & S.	⅛
Nipissing Mines	7½
Ohio Copper	1⅛
Pacific Sm. & M.	⅛
Porcupine T'nsite	‡ 03¼
Precious Metals	‡1¾
Ray Central	2
Red Warrior	‡1⅛
South Utah M. & S.	‡¾
Standard Oil (Old)	780
Stand'd Oil of N.J.	360
Stand'd Oil Subs.	335
Stewart	1⅛
Tonopah	7⅞
Tonopah Ex	1⅞
Tri-Bullion	⅛
Tularosa	¾
Yukon Gold	3⅛

LONDON Feb. 21

Name of Com.	Clg.
Camp Bird	£1 9s 6d
Dolores	1 10 0
El Oro	0 16 6
Esperanza	1 19 3
Mexico Mines	7 2 6
Oroville	0 5 6
Stratton'sInd.	0 3 1½
Tomboy	1 2 6

BOSTON EXCH. Feb. 20

Name of Comp.	Clg.
Adventure	7¾
Algomah	6
Allouez	40¼
Am. Zinc	24¾
Ariz. Com., ctfs.	4
Bonanza	.42
Boston & Corbin	6½
Butte & Balak	4½
Calumet & Ariz	60
Calumet & Hecla	430
Centennial	18¾
Con. Mercur	.03
Copper Range	53
Daly West	5¼
East Butte	12⅝
Franklin	13
Granby	35
Hancock	35
Hedley Gold	18
Helvetia	1
Indiana	14½
Island Cr'k, com.	‡43½
Island Cr'k, pfd.	86¾
Isle Royale	24¾
Keweenaw	1¼
Lake	36
La Salle	4½
Mass	8¼
Michigan	3
Mohawk	55½
New Arcadian	‡37⅝
New Idria Quick	‡7¾
North Butte	26
North Lake	6¼
Ojibway	5
Old Dominion	46
Osceola	112½
Quincy	76¾
Shannon	9⅞
Shattuck-Ariz	17½
Superior	26
Superior & Bost.	3
Tamarack	28
Trinity	5½
Tuolumne	4
U. S. Smelting	35¾
U. S. Smelt'g, pf.	48
Utah Apex	2⅞
Utah Con	15
Victoria	4½
Winona	7½
Wolverine	100
Wyandot	2½

BOSTON CURB Feb. 20

Name of Comp.	Last
Ahmeek	240
Bingham Mines	3⅜
Boston Ely	1⅜
Boswyocolo	.09
Cactus	16
Calaveras	2⅛
Chief Cons	95
Corbin	3 1/16
Cortez	1⅞
Crown Reserve	21⅝
First Nat. Cop.	2⅛
Majestic	43
Mazatan	‡⅛
Moneta Porc.	15
Nevada-Douglas	3⅞
New Baltic	4⅛
Oneco	2⅛
Raven Copper	.30
Rhode Island Coal	.26
San Antonio	‡3⅛
South Lake	5
Trethewey	.70
Union Mines	‡⅛
United Verde Ext.	.39
Vulture	‡5⅞

‡Last quotation.